Ontario
Ministry of
Labour

MINING HEALTH
AND SAFETY BRANCH

SAFETY IN ONTARIO MINES

Submission to
The Standing Committee on
Resources Development

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Table of Contents

Introduction

Section 1
Overview of Mining in Ontario
Section 2
The Mining Health and Safety Branch
Section 3
Previous Commissions and Inquiries
Section 4
Consultative Mechanisms
Section 5
Mining Accidents: Causes and Contributing Factors
Section 6
Education, Engineering and Enforcement
Section 7
Emergency Preparedness and Mine Rescue
Section 8
Future Directions and Initiatives

Appendix A
Accident Analysis Report
Appendix B
Status of Recommendations of the Ham Commission
Appendix C
Status of Recommendations of the Burkett Commission
Appendix D
Status of Recommendations of the Stevenson Inquiry

Introduction

By its very nature, underground mining is a hazardous occupation. It takes place in a harsh and hostile environment, one in which life can only be supported by the constant and unceasing use of complex machinery – machinery that sometimes fails. It is an industrial process in which heavy equipment must be used to transport large quantities of rock and ore over considerable distances. It frequently involves the use of explosives, which are themselves inherently hazardous. Refining and smelting processes pose inherent risks to workers. Finally the conditions under which miners work underground often involve problems of lighting, limited space, and ventilation which increase the risk of injury or death.

It is not surprising then that mining safety and the occupational health risks to miners have been the subject of continuing investigation for a long time. In particular there have been four major public inquiries into mining safety since 1974:

- The Royal Commission on the Health and Safety of Workers in Mines, known as the **Ham Commission**, which was established in 1974 and which reported in 1976;
- The Select Committee of the Legislature on Hydro Affairs, which was established in 1977, and which reported in 1980;
- The Joint Federal-Provincial Inquiry Commission into Safety in Mines and Mining Plants in Ontario, known as the **Burkett Commission**, which was established in 1980 and which reported in 1981;
- The Provincial Inquiry into Ground Control and Emergency Preparedness in Ontario Mines, known as the **Stevenson Inquiry**, which was established in 1984 and reported in 1986.

In addition there have been less formal studies conducted into the Workers' Compensation Act as it applies to mines and mining plants — the Weiler Reports, for example. And of course this

Committee will contribute its report to the growing body of literature on mining safety in Ontario.

Typically these inquiries have been provoked by some specific incident or occurrence, usually a major accident or increase in death or injury rates, and consequently they have tended to focus on traumatic deaths and injuries. The evidence of steadily declining accidents rates and decreasing numbers of fatalities during the past 15 years suggests that the various Commissions of Inquiry have been effective in prompting measures to reduce the risk of traumatic injury or death.

Premature deaths or disablement caused by occupational illnesses or chronic conditions have been treated somewhat differently. The Mining Health and Safety Branch, as its name implies, is responsible for occupational health issues in Ontario mines, and a great deal of emphasis is focussed on occupational health concerns within the Branch, and in Branch programs. Numerous studies, some very exhaustive, such as the Study of Mortality of Ontario Miners in 1983 and the Gold Miners Study of 1986, have researched occupational illness extensively. Further studies, such as the Muir Study into Silicosis in Ontario Mines, are ongoing. Since the circumstances that give rise to the present investigation and the terms of reference of the Standing Committee on Resources Development focus on mining safety, so does this submission.

However the absence of information dealing specifically with occupational health should *not* be interpreted as an indication that this subject is viewed as less important than occupational safety. Both are major concerns, each requires equal attention; the programs of the Mining Health and Safety reflect that fact.

Modern mining is a complex, highly technical activity, one which demands a great degree of co-operation between all of the participants. Each mine is different from every other; each requires the development of techniques, mining methods, and engineering designs that are specific to the conditions that exist in that mine, but which can not be usefully applied to any other.

Mining safety is an equally difficult and complex subject. It requires an understanding of both the issues relating to occupational safety and the specialized conditions that exist in underground mines. Regulations must be developed which can be applied in a wide range of differing situations, in mines that are frequently very different from each other.

While the principal legislative responsibility for the health and safety of miners rests with the Ministry of Labour, in practice the development of safety regulations and acceptable standards for mines and mining plants is a co-operative activity involving three parties: the trade unions representing miners; mine management, as represented by the Ontario Mining Association and the Aggregate Producers' Association of Ontario; and the Ministry of Labour.

These three parties are jointly involved in almost all aspects of mining safety, typically through so-called "Tri-Partite" Committees. In particular such committees are involved in the formal investigation of fatal accidents in mines, through the Mining Fatalities Committee, which was established in June, 1987, and the development of legislation and regulations affecting mining in Ontario through the Mining Legislative Review Committee, established in 1975.

This co-operative approach to mining health and safety has been very effective; it is considered essential to the development of effective standards, and in ensuring that those standards are universally observed in all Ontario mines. Certainly it will continue to be an important element in the future.

Steadily decreasing accident rates are evidence of the great strides that have been made in mining safety since the Ham Commission was appointed in 1974. It is equally clear that further improvements can be made in safety programs and procedures. Further research is required into safer methods of mining; into the equipment used in mining and in mine rescue; and into the behavioural factors that affect the safety of the men and women who use and manage this increasingly complex and sophisticated technology.

Section 1
Overview

1.1 Mining in Ontario

Ontario is by far the largest producer of mining products in Canada, and our mining industry is far larger than that of any other province. Table One shows the number of workers employed in the mining industry in Ontario. The table indicates the total number of operations and the number of employees regulated by the Regulations for Mines and Mining Plants (the Regulations). The Regulations are made under the Occupational Health and Safety Act (the Act) and administered by the Mining Health and Safety Branch (MHSB) of the Ministry of Labour (MOL).

Table 1.1
Mining Operations in Ontario

Type	Fiscal 86-87 Operations	Fiscal 86-87 Workers	Fiscal 85-86 Operations	Fiscal 85-86 Workers
Underground Mines	168	24,512	172	23,029
Open pit mines	49	2,692	53	2,089
Diamond Drilling	47	228	47	227
Metallurgical Plants	27	6,867	30	7,794
Metallurgical Labs	13	393	12	401
Sand & Gravel	5,972	7,080	6,042	8,157
Quarries	436	3,175	413	3,219
Others	75	541	73	641
Total	6,787	45,488	6,842	45,557

Source: Ministry of Labour Annual Report 1986-87

However for the purposes of the Standing Committee, the operations which are of interest are probably the first five categories, which comprise mining and smelting operations as they are usually understood. Those operations, which in 1986-87 totalled approximately 300 different operations employing approximately 35,000 workers, range from very small prospects with perhaps four or five employees to very large producing mines with several thousand employees.

In terms of the total numbers employed in mining, the underground mines are by far the largest category; they represent 54 per cent of the workers in the mining industry, followed by surface operations (29%) and plants and labs (16%); diamond drilling operations account for approximately one per cent of the total workers.

1.2 GEOGRAPHICAL DISTRIBUTION OF MINES

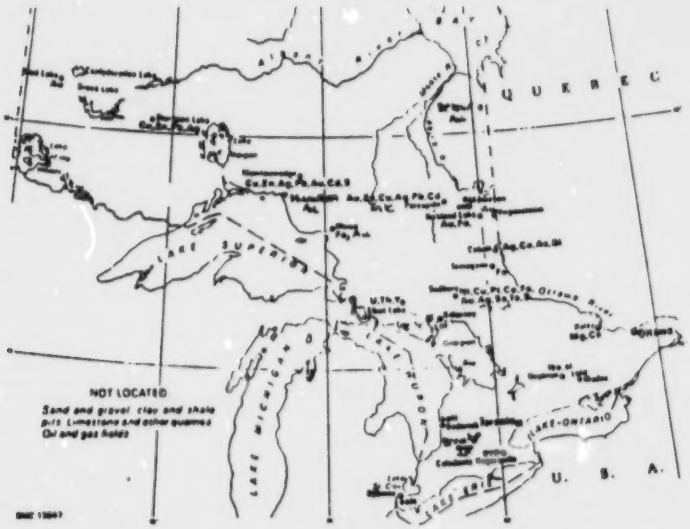
In general, most of the metal mines in Ontario are concentrated in the northern part of the province, in the geological formation known as the Pre-Cambrian Shield. These are normally called "hard-rock" mines, after the granitic rock in the region, and are generally underground mines, although there are surface open pits such as the iron mines in Kirkland Lake and Temagami. Figure 1.1 (following page) shows the distribution of the main mining operations and the principal minerals extracted.

Mines in Southern Ontario are primarily "soft rock" mines, and relatively few are deep underground mines similar to those found in Northern Ontario. The principal products extracted are salt, talc and gypsum.

Pit and quarry operations are found throughout the province, but primarily south of the Pre-Cambrian Shield, although there are also pit and quarry operations near Sudbury, Thunder Bay and Timmins.

Traumatic injuries and mining deaths tend to be concentrated in Northern Ontario, for two reasons.

Figure 1.1
Distribution of mines in Ontario and principal products.



First, there are simply more miners in Northern Ontario; more than 75 per cent of the 45,488 workers affected by the Regulations live and work in Northern Ontario. Second, underground mining presents a higher risk of traumatic injury or death, and this type of mining is much more common in the north; about 97 per cent of underground miners work in Northern Ontario.

1.3 STAGES OF DEVELOPMENT

There are four main stages in the life of a mine, each with different hazards and different requirements for regulation. The four stages are initial exploration; development; production; and mine closure.

1.3.1 Initial exploration

Exploration for new ore bodies is generally a confidential procedure. A company usually determines that a particular area shows promise, and proceeds with physical examination of the site in utmost secrecy. Exploration camps are often remote, often of short duration, sometimes accessible only by air and only during certain seasons. Prospectors, geologists and diamond drillers work in small groups and are highly mobile. As a result very little reliable information is available about safety in the early stages of exploration.

There are 5,500 licensed prospectors in Ontario, many of whom are self-employed. Some suffer injuries, and some are killed in accidents; but because they do not report through the Workers' Compensation Board (WCB) and are not eligible for compensation they tend to be not included in accident statistics compiled by the MHSB. The only regulation applicable at this stage is the requirement that prospectors be licensed under the Mining Act, which is administered by the Ministry of Northern Development and Mines, and that they obtain a "Burning Permit" from the Ministry of Natural Resources when they go into the bush in the months from April to October.

At a more advanced stage of exploration there is a greater degree of regulation. All persons working for an employer in the mining industry are covered by the provisions of the Act, the Regulations, and the Workers' Compensation Act. Under the Regulations, an employer is required to notify the Ministry of Labour "before proceeding with the operation of a diamond drill," which is to say at the point where serious exploration of an orebody begins.

Diamond drilling is extremely competitive and there are many small companies which come and go; on-site safety inspections are difficult, due to the remote location of the camps, their short duration, and

the difficulty of access. Table 1.2 shows injury statistics for diamond drillers.

1.3.2 Development

Once the decision has been made to proceed with the development of a mine there is greater scope for supervision and regulation. Permits must be obtained at different stages from four separate provincial government ministries: Northern Development and Mines, Natural Resources, Environment and Labour.

The development work includes operations like shaft sinking, the preparation of shaft stations and loading pockets, and driving drifts, crosscuts and raises. This work is usually contracted out to specialists who undertake the detailed design of the shaft, temporary headframe and hoisting plant.

The surface construction of the plant and ancillary buildings, and the permanent headframe and hoist, is usually assigned to a firm of consulting engineers which acts as the prime contractor and designer of the plant. The planning and design of the mine itself is usually done by the mine owner.

The owners of the mine or mining plant are required under section 5 of the Regulations to have the plans and design of the mine reviewed by a MOL engineer before construction begins, a process known as Pre-Development Review. The purpose of this review is essentially to ensure that safety standards are built in to the mine, and that potentially hazardous conditions are "engineered out" and thus avoided.

MOL staff make frequent inspections during the shaft sinking and construction phase since mine development is the most hazardous phase in mining, with injury and death rates that exceed any other aspect of the industry. This is a particularly difficult time for inspections, because the responsibility for various aspects of the design and construction are divided among a number of contractors, and because there is a rapid turn-over in personnel, as sub-contractors come and go. Table 1.3 shows injury statistics for mining contractors.

1.3.3 Production

Once the mine is in operation and a permanent staff has been hired there is usually an improvement in safety. Machinery and equipment are installed, the staff become familiar with their surroundings, mining methods have been established and systematized, and there is continuity in operations.

Ministry of Labour inspectors continue to ensure that there is compliance with the Act and the Regulations. In addition special attention must be paid to a variety of subjects:

- accident investigations
- safety performance
- application of the internal responsibility system
- inspection of equipment
- proper mine design
- review of new methods, equipment, designs for expansion
- inspection of environmental conditions.
- maintenance of proper ground control procedures.

Table 1.4 shows injury statistics for producing mines.

Table 1.2
Injury statistics for diamond drillers - 1987

Average no. of Employees:	802
Medical aid injury rate	34.2
Lost time injury rate	14.4
Fatalities per 1000 workers	0.2

Table 1.3
Injury statistics for mining contractors - 1987

Average no. of Employees	1851
Medical Aid injury rate	30.1
Lost time accident rate	6.7
Fatality rate per 1000 workers	1.8

Table 1.4:
Injury statistics for producing mines - 1987

Average no. of employees	25,806
Medical aid injury rate	18.7
Lost time accident rate	4.1
Fatalities per 1000 worker	0.24

Injury rates per 200,000 man-hours; fatality rate based on average employment from 1978 to 1987

1.3.4 Mine Closure

All mines have a finite life. Operations must cease and eventually the mine workings must be abandoned. So long as there are workers in the mine, the Act and the Regulations apply. When the last worker has left, responsibility for the mine rests with the owner of the mineral rights, who is responsible for maintaining the property in a safe condition by capping openings, fencing hazards such as pits, etc. In the case of Crown land, the abandoned mine becomes the responsibility of the Ministry of Natural Resources.

The regulations requiring mines which are being abandoned to be left in a safe condition are enforced by the Ministry of Labour. These regulations are found in Section 17 of the Regulations, and require that all openings be "protected to prevent inadvertent access," and that shaft and raise openings be filled or capped with concrete.

The Ministries of Natural Resources, Northern Development and Mines, Municipal Affairs, Environment and Labour are co-operating in a continuing program to locate and identify hazards on abandoned sites. MOL engineers act as agents under the Mining Act to ensure proper protective measures are taken. The cost is borne by the owners of the mineral rights.

1.4 RISK BY TYPE OF OPERATION

The risk of traumatic injury or death is not spread evenly over all kinds of mining operations, and it is possible to categorize the risk workers face according to the operations in which they are working.

Lower risk operations
In general, mining plants, mills, concentrators, smelters and refineries are the operations with the lowest risk of injury or death to workers. These operations are typically conducted above ground, in a stable environment, so that many of the hazards inherent in underground mines are not present. This category of operations accounts for 40 per cent of all mining workers in Ontario, or 18,700 workers, and 11 per cent of all mining fatalities in 1987.

The typical hazards encountered in these operations include machine guarding, housekeeping precautions; entry into tanks and bins and other confined spaces; electrical hazards.

Higher risk operations
Higher risk operations are pits and quarries and diamond drilling operations. They account for 26 per cent of workers, but 11 per cent of accidents.

Typical hazards in pits and quarries include accidents involving mobile equipment, rollovers, machine guarding, failure of banks, blasting and flying rock injuries; in diamond drilling operations the typical hazards include fire, exposure to cold temperatures, machine guarding, and inflows of methane gas.

Highest risk
The highest risk operations in mining are essentially those which take place underground: sinking shafts and doing the development work involved in "building" a mine; and production work — removing ore — from underground mines. These operations account for 34 per cent of workers, but 78 per cent of mining fatalities.

Typical hazards in underground operations include falls of rock —"ground" in mining parlance; risks involved in blasting and explosives; moving conveyances; falls; guarding equipment; and moving vehicles.

Table 1.5 summarizes the risks faced by workers in the various mining operations. Accident statistics are discussed in much more detail in Section 5 of this submission.

Table 1.5
Risk by type of operation

Operation	% all Employees	% all Fatalities	Ratio (emp./fats.)
Lower Risk plants mills & concentrators smelters refineries	40	11	0.28
Higher Risk pits & quarries diamond drilling	26	11	0.42
Highest Risk Shaft sinking Underground production	34	78	2.29

(Based on fatal accidents in 1987).

1.7 RESPONSIBILITY FOR MINING SAFETY

Internal chain of responsibility

One of the central concepts developed by the Ham Commission is the idea of both direct and indirect responsibility for safety in mines and mining plants.

Figure 1.2 shows in schematic form the direct line of responsibility for safety in mines, beginning with each individual worker and continuing through the various levels of supervisors and managers, to eventually reach the chief executive of the company. Each of the individuals in that chain bears a direct responsibility for safety and hazard abatement.

In addition there are a number of internal and external agencies and organizations which have contributory responsibility for the safety of a workplace, and which conversely bear some responsibility when accidents occur. Within the company, those organizations include the Joint Health and Safety Committee (discussed in Section 4.1), the company safety department, engineering department and purchasing department. Each of these can make important contributions to mining safety.

Outside the company, the mining unions, the Mines Accident Prevention Association of Ontario (MAPAO), suppliers of mining equipment and supplies and the Ministry of Labour all contribute to the creation of a physical and social environment in which safety is given a high priority, and in which proper mining practices are followed strictly.

A large number of groups and organizations have a substantial stake in the creation of such an environment. Figure 1.3 identifies some of these.

Figure 1.2.
Chain of responsibility for mine safety

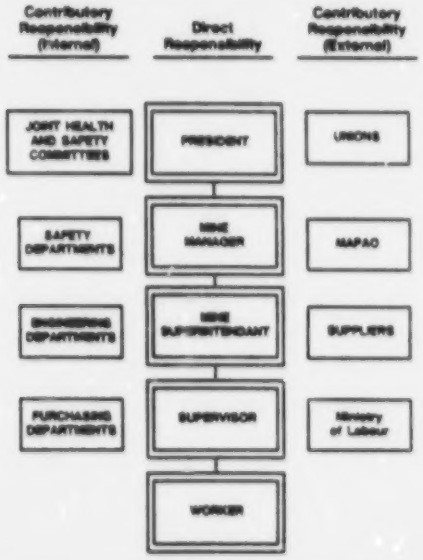
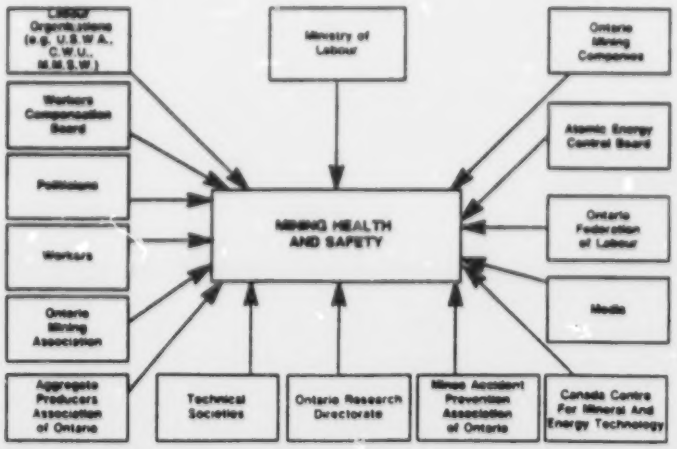


Figure 1.3
Mining health and safety stakeholders



1.8 REGULATORY ENVIRONMENT

Table 1.6 outlines the development of mining legislation in Ontario. It is noteworthy that in the past the impetus for regulatory changes to improve mining safety or emergency response facilities has been derived from tragic accidents in which miners were killed. Some of those incidents are also listed in Table 1.6.

In addition, changes in legislation and the mining regulations have resulted from the various commissions and inquiries established to investigate mining safety in Ontario. The results of those investigations are summarized here, and are discussed in detail in Section 3 and in Appendices B,C, and D.

The legislation under which safety and health in the workplace are regulated in Ontario is the **Occupational Health and Safety Act**, proclaimed in 1979. The Act introduced the concept of co-operation between management and workers in ensuring occupational health and safety. In particular, the Act established the right of workers to participate in the development of health and safety procedures (Section 8.6); established joint worker-management health and safety committees (Section 8.2); established the right of workers to full information about hazards in the workplace (Section 16.2); established the right of workers to refuse to work in unsafe conditions (Section 23); and assigned specific responsibilities for health and safety and imposed specific obligations on employers (Section 14).

The regulations under the Act are the **Regulations for Mines and Mining Plants**, (the Regulations) which were first established in 1979, and which are being constantly revised and up-dated. The Regulations are very detailed and comprehensive, and cover virtually all aspects of mining and processing. They are also subject to constant review by a formal committee composed of equal representatives of organized labour and mine management. That process, which is the responsibility of the Mining Legislative Review Committee, is described in section 4 of this submission.

The thrust of the Regulations is to establish performance objectives which specify the required result of the regulation, without specifying how that objective is to be attained. For example, the employer is required to establish an effective procedure in the event of a fire in an underground mine. The design and development of each mine is different, and the procedure will thus vary from one mine to another. The regulations do not specify what the procedure should be; only that it must exist and it must work.

Uranium mines

The two uranium mines in Elliot Lake fall under federal jurisdiction and are regulated under the Atomic Energy Control Act.. However on June 30, 1984, the Atomic Energy Control Board (AECB) adopted most of Ontario's Occupational Health and Safety Act and its regulations as the legal standard for uranium mines, and has contracted the Ministry of Labour to administer and enforce the regulations in Ontario as they apply to conventional health and safety matters, excluding radiation hazards which are regulated directly by AECB inspectors. Ministry of Labour inspectors are thus responsible for enforcing the safety and health regulations that apply to all mines in Ontario.

Table 1.6
Chronology of mining legislation and incidents

1890	–	MINING OPERATIONS ACT passed
	–	ONTARIO BUREAU OF MINES created
1914	–	WORKERS' COMPENSATION ACT passed (permitted accident prevention education)
1918	–	ONTARIO DEPARTMENT OF MINES created
1919	–	MINING ACT passed (initiated the current concept of mine safety inspection and engineering)
1928	–	HOLLINGER FIRE (Mine Rescue was initiated)
1945	–	PAYMASTER ACCIDENT (Wire Rope Testing was initiated)
1971	–	Major revisions made to the MINING ACT
1972	–	DEPARTMENT OF MINES transferred to the MINISTRY OF NATURAL RESOURCES
1976	–	HAM COMMISSION REPORT published (ROYAL COMMISSION ON THE HEALTH AND SAFETY OF WORKERS IN MINES)
	–	MINES ENGINEERING BRANCH of the MINISTRY OF NATURAL RESOURCES transferred to the MINISTRY OF LABOUR
1979	–	OCCUPATIONAL HEALTH AND SAFETY ACT and the REGULATIONS FOR MINES AND MINING PLANTS proclaimed
1980 – 1987	–	Revisions to the REGULATIONS FOR MINES AND MINING PLANTS dealing with

- Ground Control
- Underground Lighting
- Communications
- POPS
- Training
- Hours of Work
- Mine Hoisting
- Mobile Vehicles
- Working Environment
- Ground Fall Protection
- Types of Electrical Cables
- Lunch Rooms
- Explosives
- Fall Arrest Systems

Section 2
Mining Health and Safety Branch

The section of the Ministry of Labour responsible for drafting and enforcing the Regulations is the Mining Health and Safety Branch (MHSB). The mission of the Branch can be stated simply: to reduce the risk of death and injury to workers in the Ontario mining industry. This mission of course includes responsibility for occupational illnesses as well as traumatic injuries and deaths.

In order to fulfil this mission the Mining Health and Safety Branch has two sections. The Technical Support Section conducts or administers funded research into mining safety issues and provides technical advice and information to the Branch's field staff, mine operators and worker representatives. It also assists in the development of new regulations as required. The Field Operations Section maintains liaison with mining operators in the field, and is responsible for enforcement of safety and health regulations. Figure 2.1 (following page) shows the organization of the Branch; Table 2.1 shows the level of staffing in each of the sections.

2.1 ACTIVITIES

The activities of the MHSB are mainly directed toward inspection and audits of mines and mining plants; engineering reviews of new mines, new procedures or expansion of existing mines, a process known as Pre-Development Review; investigation of accidents; and providing guidance to employers on safety programs and regulations. Table 2.2 shows the proportion of time devoted to the major tasks of the Branch.

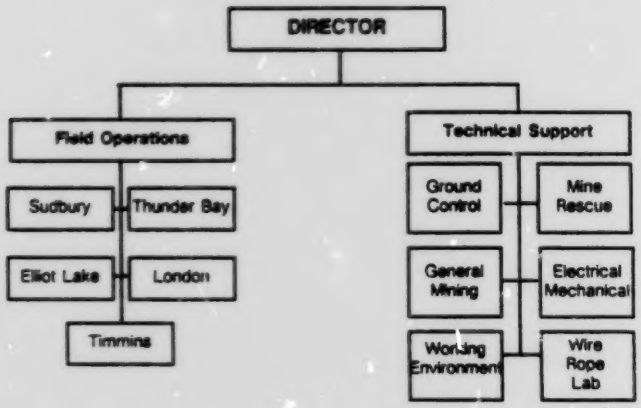
Table 2.2
MHSB Field Activities - 1987

Inspection and Audits	30%
Pre-Development Review	19%
Accident investigation	17%
Guidance to employers	16%
Investigate complaints	6%
Education and instruction	5%
Audit internal responsibility system	4%
Survey	4%

Table 2.1
Mining Health and Safety Branch Staffing. Total complement: 90

Head Office		Field Inspectorate		Technical Support	
Management	2	Management	5	Management	2
Administrative support staff	6	Administrative support	6	Administrative support	4
Special investigations officer	1	Mining engineers	4	Wire rope laboratory	5
Policy analysts	2	Electrical-mechanical engineers	6	Working environment	3
		Mining inspectors	11	Electrical-mechanical	3
Total	11	Electrical-mechanical inspectors	7	Mining/Ground control	5
		Working environment inspectors	8	Mine rescue	9
				Training	1
		Total	47	Total	32

Figure 2.1
Organization of the MHSB.



2.2 PROGRAMS

The Mining Health and Safety Branch conducts programs in 12 areas: inspection of mines and mining plants; accident investigation; accident analysis and prevention; review of mining regulations; working environment surveys; wire rope testing; education and guidance programs; training for branch staff; predevelopment engineering reviews;emergency preparedness and mine rescue; mine hazard abatement; and ground control. Each is described briefly below.

2.2.1 Inspection of mines and mining plants

The MOL establishes minimum inspection criteria for all aspects of mining operations, conducts regular inspections of all mines and mining plants in the province, and enforces the Mining Regulations.

The frequency of these inspections depends on a number of factors: the size of the operation, the number of workers employed, the stage of development of the mine, the perceived risk, and the employer's previous record in terms of safety and compliance with safety orders. For large operators, inspections covering part of the mine or plant would be done on an average of once per month.

At the conclusion of each inspection the inspector issues orders for the correction of conditions or safety procedures covered by the Mining Regulations. The orders may range from minor housekeeping items to be corrected — perhaps better storage of equipment — to substantial infractions of safety procedures — for example failure to have devices in place to prevent miners from falling. It is unusual for an inspection to be completed without an order of some kind being issued; however the vast majority involve relatively minor breaches of safety procedures.

At the end of an inspection each order issued during the inspection is discussed with the worker safety representative of the worksite health and safety committee and the employer, usually at the supervisor level, then posted on the company bulletin board, where it is accessible to all employees. Each order specifies a deadline for correction of the unsafe condition. The employer is required to respond in writing, within the specified period of time, stating that the order has been complied with. If no statement of compliance is received the inspector contacts the employer to determine why compliance has been delayed. If the non-compliance continues the inspector will consider recommending a prosecution under the Act. No repeat orders are issued.

In cases where the inspection reveals serious violations of safety procedures which pose an immediate danger to workers, the inspector has the authority to issue a stop work order. In cases where the inspector

feels that workers are being endangered by the actions of others — either workers or the employer — the inspector has the authority to stop the work and initiate an immediate investigation leading to a prosecution. Figure 2.2 shows the general trend of orders issued over the past decade. The number has been steadily decreasing — with the exception of the past three years — because of increasing voluntary compliance on the part of employers, and the action of Joint Health and Safety Committees to identify and correct workplace hazards. Table 2.3 shows enforcement statistics for the the past two years.

The Branch's enforcement programs are discussed in section 6.3.

Figure 2.2
Orders issued by MHSB, 1978-87

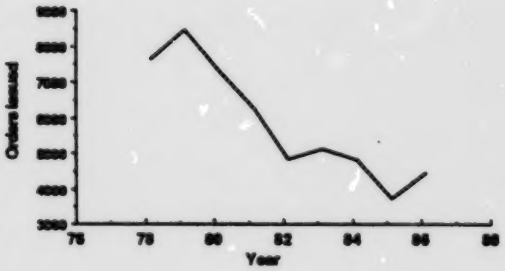


Table 2.3
MHSB enforcement statistics

Fiscal Year:	86-87	87-88
Inspections	5,548	4,445
Orders issued	4,333	3,127
Stop work orders	87	76
Work refusals investigated	32	67
Prosecutions	7	8
Convictions	3	2
Complaints investigated	186	148
Critical accidents investigated	63	40
Fatal accidents investigated	10	15
Unusual occurrences investigated	336	330

Fiscal 87-88 figures are first nine months only

2.2.2 Accident Investigation

Every accidental injury which requires medical treatment must be reported to the Workers Compensation Board. A copy of those accident reports — the "Form 7s" — is forwarded to the Mining Health and Safety Branch for assessment and, if warranted, investigation. In addition employers are required to send the Branch reports of "unusual occurrences," which are essentially incidents which may or may not involve an injury, but in which the potential for injury existed.

These include fires, falls of ground, rockbursts, hoisting failures, defective explosives and inrushes of water. An assessment of the injuries and unusual occurrences is made, and those which indicate hazardous conditions or some lapse in safety practices are investigated by the mining inspectors and engineers of the MHSB. The level of investigation performed varies with the severity of the incident.

Fatal Accidents.
All fatal accidents are invested completely and thoroughly. The scene of the accident is "frozen" — production and all normal activity are halted, and access to the area is restricted — until the investigation is completed. Safety orders may be issued immediately, and a thorough assessment of the causes of the occurrence is prepared. Other measures may be taken to prevent any recurrence of a similar accident.

The accident is reviewed to determine if the Act or the Regulations have been violated and if charges under the Act are justified.

Under the Coroner's Act a coroner's inquest is mandatory in fatal mining accidents, and investigators from the Ministry of Labour co-operate with those inquests and frequently appear as expert witnesses. Recommendations from coroner's juries are assessed and any recommendations for changes in the Mining Regulations, are reviewed and forwarded to the Mining Legislative Review Committee for consideration. The Branch also responds to the Chief Coroner concerning action taken as a result of jury recommendations.

Critical Injuries
Accidents involving critical injuries — those which threaten the miner's life — are investigated in exactly the same way as fatal accidents: statements are taken from witnesses, the scene of the accident is frozen and examined, evidence is collected. Safety orders may be issued and possible breaches of the regulations are investigated with a view to laying charges if justified.

Injuries
Not all accidents resulting in injuries are automatically investigated. The seriousness of the incident is assessed, and an investigation is begun where violations of the regulations are thought to exist, or where it is believed safety procedures may not be adequate.

Unusual Occurrences
Unusual occurrences of a serious nature are investigated thoroughly when there appears to be a potential for injuries, or where a violation of the regulations is suspected.

2.2.3 Accident Analysis and Prevention

During the investigation of fatal accidents and those causing critical injuries the causes and contributory factors that led to the incident are determined. Appendix A contains a sample of the questionnaire, called the Accident Analysis Report, used in investigating critical and fatal injuries. It indicates the depth of detail demanded in an accident investigation. All of the information is numerically coded and stored in an accident databank so that accident trends can be identified quickly and corrective measures taken. Section 5 of this submission discusses the results of this analysis and the causes and contributing factors involved in serious accidents.

Accident prevention
The purpose of investigating accidents and analyzing the causes and contributing factors is of course to prevent similar accidents from occurring again, either in the same mine or elsewhere. The MHSB conducts an active accident prevention program involving efforts at the mine where the accident occurred and on a province-wide basis.

At the mine where the accident occurred an investigation of the causes and contributing factors involved in that specific accident is conducted, including an assessment of existing safety practices. Orders will be issued where appropriate. In some cases charges may be laid under the Act. In every case the result of the investigation into the accident are made available to the employer and the Health and Safety Committee, and an effort is made to publicize the results and the use of proper preventive techniques within mines.

Provincially, the results of accident investigations and analyses are studied to determine if changes should be made to the Regulations to prevent similar occurrences in the future. Accident trends are analyzed, and in some cases special inspections or engineering reviews may be conducted, and special orders or instructions issued to employers.

The results of accident analyses and investigations are publicized throughout the mining community. Unusual occurrences are published in quarterly reports on mining safety published by the MHSB. In addition *Hazard Alerts* and *Hazard Notices* are published regularly and distributed to all mining operations in the province. Staff of the MHSB also make regular presentations to trade unions, mine managers and supervisors, miners and the general public on various aspects of mine safety.

2.2.4 Review of mining regulations

The Regulations are subject to continuous review, both by the staff of the Ministry of Labour, and by the Mining Legislative Review Committee (see section 4 of this submission). Branch staff are encouraged to compile information on possible changes in the regulations, and to solicit suggestions for changes from the workers and supervisors with whom they deal on a daily basis. These suggestions are compiled, assessed, and forwarded to the Mining Legislative Review Committee for consideration.

New regulations also arise from the continuing analysis of accident investigations and accident trends, and from new MHSB initiatives that require legislative support.

2.2.5 Wire rope testing

The Regulations provide that all new hoisting ropes installed in mines be tested to destruction to determine their strength before they are used for the first time. Samples from the same wire rope are tested again 18 months after it is first used, and then every six months so long as it is installed in the mine. The purpose of this procedure is to allow comparisons of tests results over a period of time, so that signs of possible failure are detected in advance.

The Ministry of Labour's Wire Rope Testing laboratory is the only facility of its kind in Canada, and provides testing services for a fee to other jurisdictions. The laboratory will be moved from Toronto to the new Miners' Health and Safety Centre in Sudbury.

2.2.6 Working environment surveys

The MHSB employs 10 Working Environment Inspectors whose function is to monitor environmental hazards in mines and mining plants.

The Regulations require employers to conduct regular sampling of air quality in the workplace to monitor the concentrations of certain designated and

toxic substances. The Working Environment Inspectors carry out regular sampling and monitoring of air in the workplace to check the accuracy of these tests, and audit the records maintained by the employer. The inspectors also monitor noise levels in the workplace, and the procedures developed for handling hazardous or corrosive materials. Assistance is provided to the Working Environment Inspectors as needed by specialists from the Health and Safety Support Services Branch of the Ministry of Labour.

In cases where a worker complains or refuses to work because of environmental hazards Working Environment Inspectors investigate the complaint and measure air quality to determine if a health hazard exists. Analysis of these samples is done in the MOL laboratory in Toronto. All results are reported to employer and the Joint Health and Safety Committee (JHSC), and posted in the workplace. Orders under the Act are issued where appropriate. In cases of fatal accidents, the inspectors also measure lighting levels at the accident site, if appropriate.

The substances which are monitored include dust, gases, fumes, diesel emissions, and metal fumes in smelters. The inspectors also check the use of personal protective equipment — rubber gloves, respirators, etc.

2.2.7 Education and guidance programs;

Education programs involve formal presentations on the policies and procedures of the MHSB, including the functions of inspectors and engineers. Presentations are made frequently to unions, colleges and universities, employers, supervisors and managers, workers, Health and Safety Committees etc.

Guidance consists of providing informal advice to anyone who asks for assistance in understanding or complying with the legislation and the regulations. Branch staff are frequently asked to explain how the legislation is applied, and the measures necessary to comply with it. Occasionally more complex help is required; for example MHSB staff will assist employers and workers in making submissions for engineering reviews of new processes or technology.

2.2.8 Training programs for Branch staff

The Branch maintains an active training program to keep its staff current in their disciplines. In addition training for new employees is very extensive; a new employee will receive about 100 days of training during the first two years of employment. The training curriculum covers such subjects as branch policies procedures; enforcement; the Act and Regulations; fundamentals of occupational health and safety; and investigative techniques. Regular refresher programs are also conducted. Approximately 10 per cent of total staff time is spent on training.

2.2.8 Pre-development review

MHSB staff are required to conduct a thorough review of virtually all aspects of mine design and operation before construction begins on a new mine, before any expansion of an existing mine, and before any substantial change in methods or procedures is made.

This is a very important and very extensive program and constitutes about 25 per cent of the workload of Branch engineers. It involves expert examination of new engineering drawings, specifications, procedures, mine design, training programs, and equipment, and requires a very high level of experience and training.

2.2.9 Emergency Preparedness and Mine Rescue

The MHSB employs nine mine rescue officers who are located in various parts of province. Their job is to train mine rescue volunteers from each mine in the equipment and procedures used in dealing with fire and non-fire emergencies.

They respond to emergencies and give advice on crisis management; help maintain and service mine rescue equipment; conduct regular training programs; and help organize an annual competition for mine rescue teams that serves to keep mine rescue volunteers at a peak of training.

In the past two years mine rescue has expanded its role in non-fire emergencies. The program also involves constant up-dating and research into improvements in emergency preparedness developed in other jurisdictions, and the sharing of information with other provinces and other countries.

2.2.10 Mine hazard abatement

This program deals with abandoned mines which may be a hazard to the public. MHSB engineers act as agents for the Ministry of Northern Development and Mines in identifying hazardous sites and develop corrective measures.

2.2.11 Ground control

Ground control refers to the procedures used to prevent rock in an underground mine from falling or

breaking under stress, sometimes by bursting violently. As a result of the Stevenson Inquiry the MHSB has developed new regulations for mine design and ground control. The Branch has recently recruited two new ground control engineers and embarked on a major program to audit ground control designs and practices at every underground mine in the province. This will involve input from inspectors, observations of work practices in each mine, and a review of engineering design of each mine, looking especially at rock properties, support systems, and instrumentation for recording ground movement.

2.3 SUMMARY OF MHSB STAFF ACTIVITIES

The aspectsof the Mining Health and Safety Branch programs likely to be of most interest to this Committee are those dealing with inspection of mines and engineering safety reviews. Tables 2.4 and 2.5 show the relative amounts of time spent on various aspects of Branch programs for working schedule of engineers and inspectors respectively.

Table 2.4
Activities of MHSB Engineers, 1987

Engineering analysis and pre-development review	30 %
Safety education and guidance	20 %
Accident investigation	18 %
Enforcement	17 %
Training	15 %

Table 2.5
Activities of MHSB Inspectors 1987

Enforcement	49 %
Travel	22 %
Safety education and guidance	11 %
Training	11 %
Accident investigation	7 %

2.4. COMPARATIVE SIZE OF LINE BRANCHES WITHIN THE OCCUPATIONAL HEALTH AND SAFETY DIVISION

The Mining Health and Safety Branch is one of three branches of the Ministry of Labour responsible for occupational health and safety, the others being the Construction Health and Safety Branch and the Industrial Health and Safety Branch. For purposes of comparison the number of inspectors and the size of the industries regulated by each of the branches is shown in table 2.6.

Table 2 .6
Comparative size of line branches within the Occupational Health and Safety division.
(Fiscal 86-87)

Branch	Inspectors	Workers covered	workplaces
Construction	66	257,000	21,399
Industrial	111	3,200,000	150,000
Mining	26	45,501	6,795

2.5. OCCUPATIONAL HEALTH

The Mining Health and Safety Branch devotes substantial resources to occupational health issues. The Ministry of Labour has commissioned a number of studies into health in mines, including the Ontario Miner Study conducted by Dr. Jan Muller. The study was done in two phases, the first completed in 1983 and the second in 1986. The Muller study identified an increase in lung cancer mortality among uranium and gold miners. With respect to gold miners, further investigations are now seeking to determine why this has occurred, and to find ways to prevent a recurrence in the future. Similar epidemiological studies, some involving many thousands of miners, are investigating illness rates in other types of mines.

The Ministry of Labour and the Ontario Mining Association jointly financed a study by Dr. David Muir of McMaster University into silica in mines, in order to establish a better standard for airborne respirable silica. The results of that study will be released soon, and will probably result in new regulations, or per-

haps a new standard to be adopted by Ontario mines.

Important research has also been conducted into diesel emissions in underground mines; that research led to the development of a ceramic filter for removing particulates from diesel exhaust which is expected to be widely used in a number of jurisdictions as well as in Ontario.

The Ministry of Labour has also provided large scale funding for respirator research to be undertaken at Laurentian University. The proper design and functioning of respirators used in the mining industry is being investigated. A particular concern is toxic dusts in mining plants and smelters.

Because of the long latency periods involved in occupational illnesses, the health issues surrounding this topic are very dificult to predict and control. The latency periods may vary from a few years to more than three decades, and the victims may be people who no longer work as miners, and so are more difficult to track. Changing conditions over that period of time, and the lack of proper records from previous eras makes it difficult to conduct solid research, and to reach useful conclusions.

In particular statistics of deaths due to occupational illnesses are misleading, because they are recorded in the year the individual is awarded compensation, so changes in WCB criteria may result in sudden bulges in the mortality figures and make the data unreliable.

Despite the difficulty of developing accurate and comparable statistical information on occupational illnesses, it is extremely important to limit the exposure of workers to toxic substances. In November 1986 the government filed Regulation 654, which deals with toxic substances. This Regulation, which came into effect in December 1986, set exposure limits for some 600 toxic substances, in addition to the 12 designated substance regulations.

Section 3
Previous Inquiries and Commissions.

Since 1974 there have been four major inquiries into various aspects of mining health and safety. Typically these inquiries were established in response to either specific mining accidents or a general increase in fatalities. Their recommendations and the actions prompted by them have made significant contributions to mining safety in Ontario. The Committee has already received a report of the conclusions reached by the various investigations and the actions taken on their recommendations. In addition, Appendices B, C, and D contain very detailed listings of every recommendation of each of the Inquiries, and synopses of the actions taken. For convenience the inquiries are summarized below.

3.1 ROYAL COMMISSION ON HEALTH AND SAFETY OF WORKERS IN MINES (THE HAM COMMISSION)

The Ham Commission was appointed to investigate health and safety in Ontario mines, with particular attention to working conditions and the working environment. The Commission provided extensive data on occupational health among miners, including data on the incidence of silicosis and lung cancer. The Commission also investigated the operation of the Workers' Compensation Board as it related to miners.

The Ham Commission had a profound impact on occupational health and safety legislation in Ontario. The principal outcome of the Commission, which issued its report in 1976, was the promulgation of the Occupational Health and Safety Act, which collected all occupational health and safety legislation in one act. The Act established the framework for the Internal Responsibility System, which is a concept that shares responsibility for occupational health and safety in mines among all of the parties in the workplace: owners, managers, supervisors, and workers. Manifestations of this idea are the Joint Health and Safety Committees established under the Act; the right of workers to refuse unsafe work; and the obligation imposed on management to inform workers of hazardous conditions.

The Commission also resulted in the establishment of the Ontario Miners Study, which provided data on mortality rates among miners, and on the establishment of provincial air quality standards for mines. The present modular training program for miners was also a direct result of the Commission as was the amalgamation of provincial government programs dealing with occupational health and safety in the Occupational Health and Safety Division of the Ministry of Labour.

3.2 SELECT COMMITTEE ON ONTARIO HYDRO AFFAIRS

The Select Committee, which reported in 1980, was established primarily to investigate the costs of providing electric power, and to review Ontario's commitment to nuclear generating stations in light of possible environmental and health impacts. However the Committee also reviewed the implementation of the Ham Commission recommendations, issued four years earlier, as they applied to uranium mines.

The Committee identified hazards associated with underground mining in general, and additional risks facing miners in uranium mines: a work environment with relatively elevated levels of background radiation, in ore with a high silica content. The Committee

found that health and safety had improved since the publication of the Ham Commission report, but concluded that additional measures should be taken to protect individual miners from exposure to radiation and silica.

Many of the Committee's recommendations dealt with such issues as nuclear waste disposal, jurisdiction over uranium mines, and environmental issues. However as a result of the Committee's recommendations Ontario's Health and Safety Regulations have been adopted for uranium mines, and a regulation was passed designating silica as a "designated substance" whose presence must be monitored and controlled.

2.3 JOINT FEDERAL-PROVINCIAL COMMISSION OF INQUIRY INTO SAFETY IN MINES AND MINING PLANTS IN ONTARIO (THE BURKETT COMMISSION).

The Commission was appointed in early 1980 — that is while the Hydro Select Committee was preparing its report — in response to an alarming increase in fatalities and lost-time accidents in Ontario mines. The Commission was mandated to review safety in Ontario mines and mining plants, including those under federal jurisdiction.

As a result of the Commission's recommendations the Ontario Mining Association, which represents mine owners, was separated from the Mines Accident Prevention Association of Ontario.

The Commission also gave rise to a number of studies of factors contributing to accidents. Two in particular may be of interest to this Committee. The Moon Report examined the relationship between the bonus system and accidents, and came to the conclusion that bonus has no impact on accident rates when other factors like age, occupation experience and the task at hand were taken into consideration. The second study investigated mine lighting levels, a subject of great complexity, and resulted indirectly in the adoption of a new regulation, Section 65a, which sets lighting standards for mines. The regulation was adopted in 1987 and comes into force in June 1988.

The Commission's report also gave expression to the concept of both direct and contributory responsibilities for safe production, and suggested methods of establishing the accountability of the workplace parties for safety, and for involving of a wide variety of stakeholders in the process of producing ore safely.

2.4 PROVINCIAL INQUIRY INTO GROUND CONTROL AND EMERGENCY PREPAREDNESS IN ONTARIO MINES (THE STEVENSON INQUIRY)

The Stevenson Inquiry was appointed as a direct result of a rockburst at Falconbridge in June, 1984, in which four miners were killed. The Inquiry published its report in March, 1986.

The Stevenson Inquiry identified a number of areas where new regulations have since been enacted: in mine design; lighting; fall-on-protection for vehicles; communications; and ground control training.

In addition the Inquiry identified lapses in the technology of ground control, and suggested a substantial increase in spending for research in this area. As a result a Mining Research Directorate has been formed, funded by the mining industry, to co-ordinate research activities in Ontario. Three chairs in rock mechanics have been established at Ontario universities — one funded by the mining industry, two by the government of Ontario — to provide post-graduate training in ground control for engineers. A centre where industry personnel are trained in ground control has also been established at Cambrian College. The Mining Health and Safety Branch has also recently hired two additional ground control engineers, and is currently conducting a ground control audit of every mine in Ontario.

The Stevenson Inquiry also made a number of recommendations with respect to emergency preparedness and mine rescue. In response to those recommendations the MHSB, with the assistance of the Mine Rescue Committee, has prepared a Crisis Management Manual to help mines improve their response to emergencies and their ability to manage crises. A data base showing the location of specialized mine rescue equipment has also been established. The Mine Rescue Organization is being expanded to improve its capacity to deal with non-fire emergencies, and a substantial amount of new equipment has been purchased.

Section 4.
Consultative Mechanisms

The fundamental model for virtually all health and safety activities related to mining is the so-called "Tripartite Committee" — tripartite because it is composed of representatives from the three major parties involved in mining in Ontario: labour, through the trade unions representing miners; management through the mine owners and operators; and government, through the Ministry of Labour. While the Ministry of Labour is responsible for formulating and enforcing mining regulations, these tripartite committees provide advice and expertise on virtually every aspect of mining safety and health.

In addition to the tripartite committees, which typically operate at the provincial level, there are direct mechanisms for consultation between workers and supervisors in the workplace. Finally there are mechanisms for co-operation with other provinces and with other countries to exchange information and report developments in mine safety.

4.1 CONSULTATIVE MECHANISMS IN THE WORKPLACE

Direct communication between workers and supervisors — or management — is essential for the maintenance of a safe workplace. This direct communication allows workers and supervisors to identify and correct hazards before accidents occur. One of the principal vehicles for this type of communication is the Joint Health and Safety Committee.

Before the enactment of the Occupational Health and Safety Act, Joint Health and Safety Committees were a matter of negotiation between mine management and the trade unions representing workers. However the Act makes the formation of a Joint Health and Safety Committee mandatory in all workplaces which regularly employ more than 20 workers.

The Joint Health and Safety Committee (JHSC) is comprised of representatives of management and labour. A worker representative on the JHSC has the authority to conduct inspections of working conditions once a month. Workers and management have an obligation to provide whatever information may be required to make these inspections effective. The JHSC is empowered to identify hazardous conditions and make recommendations to the employer for correcting them. Normally these recommendations are made during a meeting of the Health and Safety Committee, and the minutes of these meetings are reviewed by Ministry of Labour staff.

In cases where there are accidents that result in death or critical injury, the worker representative on the JHSC is empowered to inspect the accident site and report the findings directly to the Director of the Mining Health and Safety Branch.

Informal mechanisms for reporting hazardous conditions in mines also exist. It is common, for example, for miners to report conditions considered hazardous directly to foremen or supervisors. However the Joint Health and Safety Committee provides a mechanism for ensuring that unresolved concerns are formally collected and acted on in a systematic way.

4.2 PROVINCIAL TRIPARTITE COMMITTEES

Tripartite Committees — that is committees composed of representatives of labour, management and government — have become the normal mechanism for ensuring adequate consultation between all of the participants on the business of mining and processing

ore. The reason for this approach is simple: safety in mines and mining plants requires the co-operation, support and participation of all the people involved in mining; the tripartite system provides a means of supporting that process and giving it practical expression. The major tripartite committees operating in Ontario are the Mining Legislative Review Committee, the Committee on Mining Training, the Committee on Mining Fatalities, the Mine Rescue Advisory Committee, and the Labour-Management Committee on Hazardous Substances.

Mining Legislative Review Committee (MLRC)

The Mining Legislative Review Committee (MLRC) was formed in 1975 to review the provisions of the Mining Act and draft regulations relating to safety and health in mines and mining plants. Appointments to the MLRC are made under the authority of section 11 of the Occupational Health and Safety Act by the Minister of Labour from nominees submitted by labour and management.. The committee consists of eight appointees — four each from labour and management — and a neutral chairman — and meets approximately four times a year.

Suggestions for changes in the mining regulations are submitted to the MLRC by committee members, and by the staff of the Ministry of Labour. In addition, every mining fatality is investigated by a coroner's jury, and any recommendations dealing with changes in mining regulations are referred to the MLRC for review.

The MLRC frequently appoints sub-committees to investigate specific areas of mining safety — for example sub-committees are currently investigating the presence of radon daughters in non-uranium mines, mine hoisting standards, and mine electrical standards, among others, with a view to drafting new regulations.

Virtually all changes to the Regulations are first reviewed by the MLRC, although the regulations themselves are issued by the Minister of Labour, who may accept or reject the recommendations of the Committee.

Committee on Mining Training (CMT)

The Committee on Mining Training (CMT) is appointed under the authority of Section 11 of the Act to develop training programs for miners. After an initial orientation program, training for miners in Ontario is mainly done on the job, and consists of a series of "modules" designed to develop specific skills. These modules are divided into two sections: the "Common Core For Basic Underground Mining Skills," which must be mastered by every underground miner; and "Specialized Underground Mining Skills."

The training is essentially practical training in the operations performed by underground miners, and each miner is required to demonstrate a specific level of competence or skill in each of those operations. Under changes to the Regulations passed in the summer of 1987, the appropriate training must be given within the miner's first year of employment. Other changes to the regulations established a similar training program for first-line supervisors.

The "modules" which make up the training programs are developed by the Ministry of Skills Development, in conjunction with the Committee on Mining Training and the Ministry of Labour. There is no system of apprenticeship for miners; however, a record is kept of a miner's training, and a certificate is issued by the Ministry of Skills Development which indicates the miner's level of competence.

Mining Fatalities Committee (MFC)

Section 2 of this submission describes in detail the procedures followed by the staff of the Ministry of Labour when a miner is killed or critically injured in Ontario. In addition to that investigation, the Mining Fatalities Committee, which has submitted a brief to this Committee, attempts to develop policies and programs of a general nature which will prevent future fatal accidents from occurring. The MFC was established in the summer of 1987 in response to an alarming increase in the incidence of fatal accidents in Ontario mines to attempt to develop an understanding of the causes of fatal accidents, and effect methods of preventing them.

The Committee meets as required, and is currently pursuing four major initiatives:

- the concept of "fail safe" design for mining equipment, mine design and production procedures;
- a review of accident and fatality statistics with a view to developing a standardized database which will permit more accurate comparisons, and suggest programs for accident prevention;
- the improvement of the Internal Responsibility System first suggested in the Ham Commission Report;
- the investigation of the role played by attitudes and culture in the causation of mining accidents.

The MFC, which is jointly funded by the mining industry and government agencies, has contracted outside researchers to conduct research and produce studies in several areas reflecting these concerns.

Advisory Council on Occupational Health and Occupational Safety

The Advisory Council on Occupational Health and Occupational Safety (ACOHOS) is a multi-partite

committee which advises the Minister of Labour on matters relating to occupational health and safety that may be brought to its attention or referred to it. Members of the council are representative of management, labour and technical or professional persons and the public who are concerned with and have knowledge of occupational health and safety.

During the 1986-87 fiscal year, the Council submitted advisory memoranda to the minister on the establishment and functioning of joint health and safety committees; consultation; reviews of the process used to develop the proposed designated substance regulations for lead on construction projects; and ethylene oxide.

The advisory memoranda and the minister's responses, as well as correspondence relating to previous advisory memoranda and other matters are included in council's Ninth Annual Report.

Mine Rescue Advisory Committee

The Mine Rescue Advisory Committee was established in 1987 as a result of the Stevenson Inquiry to co-ordinate developments in mine rescue as it relates to non-fire emergencies. The Mine Rescue Organization (which is described in detail in section 7 of this submission.) was originally developed in response to a disastrous mine fire in 1928, and fire underground has remained a principal concern of the organization.

The Stevenson Inquiry recommended that the Organization be expanded to improve its capacity to deal with non-fire emergencies. The Advisory Committee was established to comply with that recommendation.

The Advisory Committee consists of nine members appointed according to the usual tripartite criteria, and meets twice each year, or more frequently if required. The Committee's principal project at the moment is the development of a crisis management resource manual which will assist mine management in developing and organizing an emergency preparedness program. The resources manual, which shows such information as the availability of specialized mine rescue equipment, is now in the final stages of preparation. In addition the crisis management program is designed to assist mine managers and supervisors in shifting from normal operations to the specialized management techniques required in an emergency situation.

The Advisory Committee has also started accumulating information and materials relating to mine disasters in other jurisdictions, and to gather information on mine rescue techniques used in other countries. The Committee also makes recommendations for the purchase of equipment required for non-fire emergencies.

Labour-Management Committee on Hazardous Substances.

This tripartite committee was formed by the Minister of Labour in late 1987 with a mandate to review the way hazardous substances are regulated in Ontario — not only in mines, but in all industrial applications. The Committee is chaired by the MOL's Assistant Deputy Minister, Occupational Health and Safety Division, with representation from various industrial sectors and labour groups. The Committee has just been formed and has held two meetings at this point.

There has been a great proliferation of regulations concerned with health issues, designated substances and biological and chemical agents, the right of workers to know what substances are used on their jobs, and Workplace Hazardous Material Information System legislation. This committee is examining the entire question of the regulation of hazardous materials in the light of the existing regulation and legislation.

Mining Research Directorate (MRD)

The Stevenson Inquiry identified a need to co-ordinate mining research in Ontario, specifically with respect to ground control. As a result the Ontario Mining Association formed a Research Directorate to identify research needs, locate sources of funding, and co-ordinate research efforts. Representatives from labour, industry and government sit on the board of directors and a managing director has been appointed. The MRD is located on the campus of Laurentian University in Sudbury.

4.3 NATIONAL and INTERNATIONAL AGENCIES

In addition to consultation and co-operation among labour, management and government at the provincial level, the Ministry of Labour co-operates actively with other jurisdictions in sharing information about mining safety and in developing improvements in accident prevention. Among the mechanisms developed so far are:

° a national study of mining fatalities;

° the development of a national database allowing for comparison and investigation of statistical information relating to mine safety;

° co-operative agreements among the US. Bureau of Mines, the Canada Centre for Mineral and Energy Technology (CANMET) and the Ministry of Labour;

° the National Chief Inspectors of Mines Committee which shares information about mining safety;

° Agreements for the exchange of information with other countries, including Germany.

Section 5
Causes and Contributing Factors in Mining Accidents

The Mining Health and Safety Branch maintains records of accidents and other safety-related incidents. These records become part of a database which is used to analyze accident trends, and to identify areas of high risk, so that special preventive measures can be put into place. Since much of the discussion that follows will deal with this statistical material, it may be helpful to describe briefly some of the terms and approaches used.

Accident statistics usually do not deal with numbers of injuries or deaths but with the *frequency* of these occurrences. The raw numbers provide no information about the number of workers who are at risk, and for that reason they are somewhat misleading. It is usually more useful, for purposes of accident prevention, to have some standardized basis of comparison which makes it possible to identify areas of higher risk.

Figures 5.1 and 5.2 illustrate this point. Figure 1 shows the number of fatal mining accidents in Ontario from 1974 to 1987. As the graph illustrates, there is no clearly defined trend. Figure 2 shows the frequency of fatal mining accidents for the same period, expressed as the number of deaths per million man-hours worked. The fatality rate has been relatively stable until the past three years, and then shows a dramatic up turn.

One further caution is necessary in discussing fatality rates. Fortunately the number of fatal accidents is relatively small; they are relatively rare occurrences. Because the number of fatal accidents is small in comparison with all lost-time accidents, a very small change in the number of deaths — perhaps the result of a single accident — can result in a distorted perception of accident trends. For this reason it is often necessary to consider fatal accidents over a longer period of time, and to use averaging techniques

Figure 5.1
Fatalities in Ontario mines, 1974-87

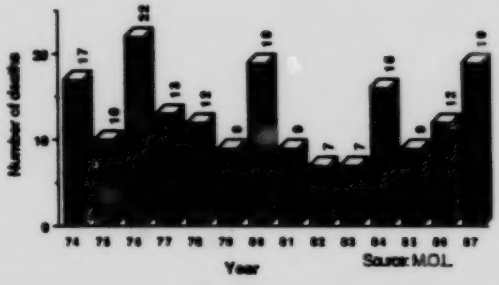
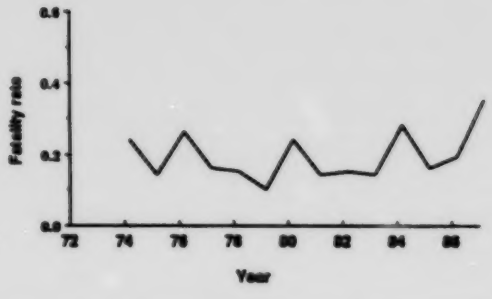


Figure 5.2
Fatality rate per million man-hours, 1974-87



that smooth out unusual occurrences, before trends are clearly visible. Figure 5.3 shows the long-term trend in fatality rates in Ontario.

It is much easier — because of the much larger number of occurrences — to speak with confidence about trends in lost-time accident rates. Until recently it was generally believed that fatal accidents are closely connected to lost-time injuries — they were said to represent the "tip of the iceberg" — and that downward trends in lost time accidents would invariably be followed by similar trends in the rate of fatal accidents. Over the long term there is a correlation between rates of lost-time accidents and the fatality rate; but recent accident trends have weakened that correlation, and shaken confidence in the dictum that the way to reduce fatalities is by reducing lost-time accidents. Figure 5.4 shows the comparative trends from 1974 to 1987.

The evidence is far from conclusive but the trend is disturbing, because fatal accidents are unpredictable random events. The only method we have developed to reduce the rate of accidental deaths is to create an environment in which safety is given special weight and importance, and in such an environment accidents of all types should decrease.

Particular care should be used in attempting to compare fatality rates from traumatic accidents and occupational illnesses. Occupational illnesses are not defined in a uniform manner by different jurisdictions, which makes data comparisons difficult. In addition, deaths attributed to occupational illnesses are assigned to the year in which the death claim is accepted by the Workers' Compensation Board; when a new class of illness is accepted for compensation the statistics for deaths attributed to occupational illnesses show a sudden peak which does not reflect reality. Finally the long latency periods for occupational illnesses mean that the deaths reported in any given year reflect conditions as they were many years in the past, and the information is not of much value in attempting to improve current health and safety conditions. The problems of occupational illness are much more difficult to resolve, and attempts to compare the data for occupational accidents and those for occupational illnesses tend to obscure those problems rather than clarify them.

However it is possible to compare accident rates in Ontario with those in other jurisdictions, and this information can be helpful in indicating the relative ranking of safety efforts here with those in other provinces and other countries. Figure 5.5 shows the rate of fatal accidents in Ontario, Sweden and the United States from 1978 to 1984 (the latest period for which figures are available). Figure 5.6 shows the rate of lost-time accidents in Ontario mines compared with those in Quebec and British Columbia, the provinces with mining industries are roughly comparable to Ontario's. Unfortunately because of differences in the way information is collected it is not possible to compare fatality rates among provinces, or between Ontario and Canada as a whole. This is one of the issues being addressed through the National Mining Incidents Database which is being established

Finally, Figure 5.7 shows fatality rates in mining in Ontario compared with other industries in the province.

Figure 5.3
Mining fatalities in Ontario, 1920-87

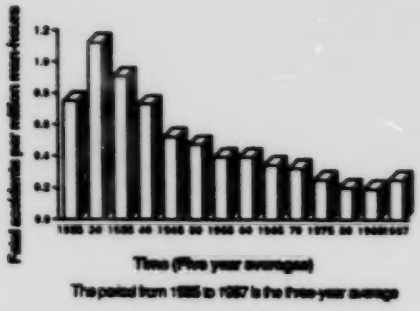


Figure 5.4
Lost time injury rate compared with fatalities.

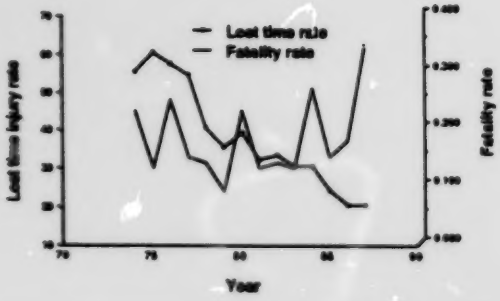


Figure 5.5
Fatal accident rates in Ontario, Sweden and the USA.

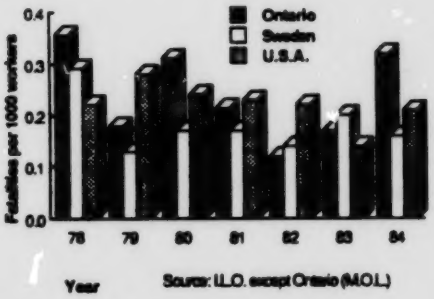


Figure 5.6
Lost time accidents in Ontario, Quebec and B.C.

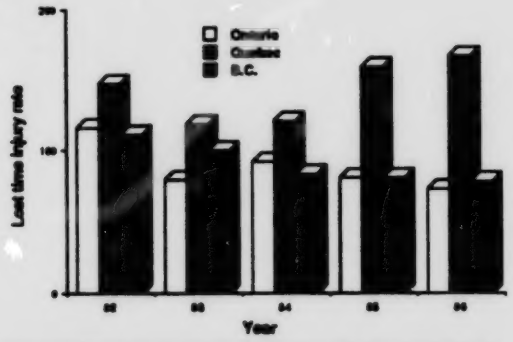
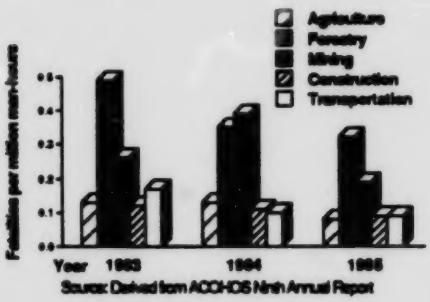


Figure 5.7
Fatalities in mining compared to other industries in Ontario



5.2. ACCIDENT ANALYSIS

The purpose of collecting and comparing statistical information is to provide guidance to safety improvement programs. The following graphs and the table indicate various approaches to the analysis of accident information.

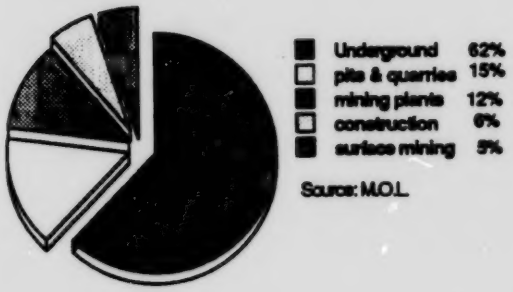
Table 5.1
Deaths and injuries by company, 1987

Company	No.of fatalities	Lost time injury rate
Inco	7	2.7
Giant Yellowknife	1	1.8
Falconbridge	1	3.5
Rio Algom - Panel	1	1.7
Agnico Eagle	1	6.2
Adams Mine	1	3.0
Contractors		
Alex MacIntyre	1	11.8
J.S. Redpath	1	2.4
P. Harrison	1	10.1
MacIsaac	1	8.4
Thyssen	1	n.a.

Table 5.2
Lost time injuries by company, 1987

Company	Average No. of Employees	Lost Time Injury Rate
GOLD MINES		
Campbell	487	3.5
Detour Lake Mines Ltd.	178	3.2
Dickenson	51	3.9
Dome	74	2.8
Giant Yellowknife	762	1.8
Golden Shield Resources	342	2.2
Hemlo Gold Mines	252	2.4
K. Creek - Hoyle Pond/Owl Creek	108	1.1
Lac Minerals - Page-Williams	426	0.9
Lac Minerals - Lakeshore(Closed)	40	0.0
Lac Minerals - Macassa	291	4.3
McBean	20	0.0
Naramco-Golden Rose Mine	45	4.5
Renabie	187	1.1
Teck-Corona	182	9.5
Total gold mines	**4,415**	**2.6**
NICKEL MINES		
Falconbridge Ltd.	2,230	3.5
Inco - Ontario Division	8,745	2.7
Total nickel mines	**10,975**	**2.9**
URANIUM MINES		
Denison	1,799	4.0
Rio-Algom - Panel	745	1.7
Rio Algom - Quirke	1,210	4.3
Rio Algom - Stanleigh	624	4.3
Total uranium mines	**4,378**	**3.7**
CONTRACTORS		
AMS Canada Inc.	71	47.5
Aurora Quarrying	63	16.2
Boart	35	29.6
Canadian Mine Dev.	61	20.0
Cementation	4	37.4
Dyntec Contracting	93	22.8
Graham Mining Ltd.	74	8.2
Patrick Harrison	100	37.2
A. MacIntyre	72	31.6
MacIsaac	433	39.4
Manroc Dev. Inc.	17	70.4
Mining Corp. of Canada	130	32.8
Ram Raising Ltd.	31	30.3
J.S. Redpath	644	26.0
Ross-Finlay	23	29.7
Total contractors	**1,851**	**38.1**

Figure 5.8
Location of fatal accidents



Source: M.O.L.

Figure 5.9
Distribution of accidents by worker experience

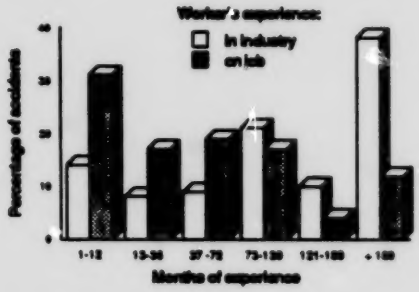


Figure 5.10
Distribution of accidents by worker age

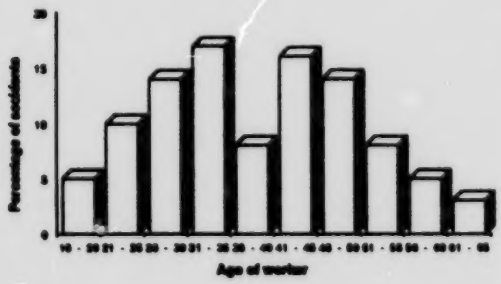
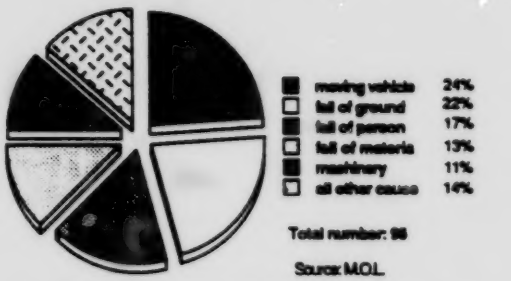


Table 5.3
Types of serious and fatal accidents investigated in 1987

Accident type	Percentage of total
crushed between two objects	22
struck by object	19
fall of object	16
slip or fall	12
mechanical transportation	6
fire	5
fall different levels	4
inhalation/ingestion	4
failure - equipment	3
striking an object	3
explosion	1
using object	1
unclassified	1

Total number: 77

Figure 5.11
Causes of fatal accidents 1974-87



Source: M.O.L.

Other causes include hoisting, explosives explosions, electrocution, and environment

5.3 CONTRIBUTING FACTORS IN MINE ACCIDENTS

Appendix A contains a copy of the detailed form used in the investigation of serious and fatal accidents in mines. This information is all numerically coded and entered into an accidents database so that the direct causes and contributory factors can be analyzed.

There are two principal classifications used in analyzing the causes and contributing factors involved in accidents: **improper conditions**, which refers to unsafe or hazardous conditions in the workplace; and **improper practices**, which essentially involve workers doing something or failing to do something that causes a hazard. The distinction is significant, because each requires different corrective measures. Accidents caused by improper conditions are those which might be prevented by better housekeeping, for example, or better guarding of equipment. In an ideal world, they could be "engineered out" of the workplace. Accidents caused by improper practices are those which might be prevented by improved training, for example, or safety awareness programs.

Frequently accidents are found to have more than one "major cause," but in general improper practices are responsible for about 60 per cent of serious or fatal accidents; improper conditions account for about 40 per cent. Specifically, of 77 such accidents investigated in 1987, and whose investigation was complete at the time of writing, there were 112 "major causes" attributed to improper practices, and 68 to improper conditions.

Improper practices

Accidents attributed to improper practices are subdivided according to the major causes of the accident, as determined by the investigator. Table 5.4 shows the results.

Personal Factors

Accidents attributed to improper practices are essentially those attributed to "human factors" — accidents in which the principal cause lies with something a miner did or failed to do. Table 5.5 shows a breakdown of the human factors contributing to the accidents attributed to improper practices.

The Committee should note that this does not imply that the individual miner was at fault in these accidents. The miner is one link in the chain of responsibility for safety, and accidents attributed to improper practices may well have their origin elsewhere — in inadequate training or supervision, for example.

The Committee expressed an interest in illiteracy as a contributing cause in accidents. The MHSB did not identify any serious or fatal accidents in 1987 in which this was a contributing factor. This is scarcely surprising, since illiteracy is not included on the Accident Analysis Reports, and our investigators are not looking for it specifically in their investigation. An informal survey of inspectors and engineers indicates that it is not believed to be a significant contributor to accidents, except to the extent it may blunt the effectiveness of safety awareness programs.

Table 5.4
Major causes of accidents attributed to improper practices - 1987

Cause	Percentage of total
failure to observe	16
taking improper position	14
failure to warn, insure, secure	14
fail to use safety device, equipment	13
other	8
improper, inadequate, or defective equipment	6
fail to use protective equipment	5
failure to communicate	5
servicing equipment in motion	4
use equipment improperly	4
making safety device inoperable	4
improper load, lift or placement	2
disobey instructions	1
operating without authority	1
operating at improper speed	1
horseplay	1
failure to respond promptly	1
drinking or drug use	0

Table 5.5
Personal factors contributing to accidents attributed to improper practices

Factors	Percentage of total
lack of safe job procedure	25
other	24
self-urgency	15
lack of safety training	7
lack of knowledge or skill	7
lack of proper job training	6
risk-taking personality	6
abuse of equipment	4
or material	3
pressure from supervision	1
physical body limitation	0
dissatisfied with job	0
physical or mental fatigue	0
job security and prospects	0
lack of motivation	0

Improper conditions

Table 5.6 shows a break-down of the major causes of accidents attributed to improper conditions. The information speaks for itself, except that the Committee should note that the "other" category includes a large number of causes, none of which was responsible for a significant proportion of accidents. However the other three items in the first four — guards or protection on equipment, the use of tools, equipment or hazardous substances in some way that was considered improper, and the layout of the workplace — account for almost 60 per cent of the accidents in this category.

Table 5.6
Major causes of serious or fatal accidents attributed to improper conditions, 1987

Cause	Percentage of total
guards or protection	29
other	19
tools, equipment, substances	18
layout of workplace	12
hazardous atmosphere	6
fire or explosion hazards	4
warning system	3
congestion	3
housekeeping	3
illumination	1
ventilation	1
radiation exposures	0
noise	0

Section 6
Engineering, Education and Enforcement

Engineering, education and enforcement are frequently described as the "Three E's of Mining safety." Each plays an important part in reducing accidents.

6.1 ENGINEERING

A number of engineering programs have been initiated to reduce the number of mining accidents. Among them:

Pre-development Review

An engineering review is conducted when new mining process technology is to be used; when the use of new methods of construction or new equipment is proposed; or when major alterations of mining techniques or technology are contemplated.

In accordance with section 18 of the Act and section 5 of the regulations, an owner must give notice of major changes to the workplace to the Director and to the Joint Health and Safety Committee. The normal process is that the notice is forwarded to the nearest office of the Mining Health and Safety Branch. The branch engineer subsequently will require the owner to provide general arrangement drawings, specifications or other information to enable a review of the project to be conducted to ensure it complies with the legislation and good engineering practice. These reviews are carried out by the District Engineers; additional technical assistance is obtained from the Branch specialists in ground control, ventilation, mechanical engineering, etc., as required.

This process is designed to identify hazards in the design of the workplace and flag them. This enables the owner to make modifications in the design, which minimizes the risk to workers and the need for costly retro-fitting of modifications after construction. About 23 per cent of staff time is devoted to Pre-Development Review.

The review process is specifically a review of the project for compliance with the Act and regulations. The MHSB has intentionally avoided the role of approving the plans, as approvals would imply a level of responsibility that the Branch feels it cannot discharge.

Pre-development Reviews are mainly done by MHSB field staff, either on-site or, for larger projects, in the area office. Advice of the Chief Engineers and their staff is requested for the more complex projects. The review process includes inspections of the worksite during construction or installation, to assure that the project is built in accordance with the reviewed drawings.

Engineering Analyses

Branch engineers review components of mines and mining plants that come to their attention as a result of accidents, unusual occurrences, routine inspections, complaints and requests from the workplace parties (workers and employers). In these circumstances, an engineer carries out a review and assessment, not so much to determine compliance with the legislation, but to assess the safety related qualities of the workplace, equipment, process or design. In some cases a change in design of a workplace or a piece of equipment will eliminate reliance on procedures to reduce worker risk.

In 1987 the Branch designed a program for carrying out engineering audits of each underground mine's ground control programs. This program will require input from the Branch's field staff, the employer, and workers. A site visit forms part of the ground control engineer's analysis, with the end product being a

report with recommendations which will be issued to the employer.

Fail-safe Design

Recognizing that systems, people and equipment do occasionally fail, Fail-Safe attempts to ensure that the losses incurred by any such failure will be minimal to equipment and production, and non-existent with regards to the safety of workers and the public.

A Fail-safe Analysis requires the formation of a team of people who have detailed technical knowledge of the process or workplace which is under study. Hazards are identified and assessed pro-actively to engineer them out, or put in place procedures which minimize potential for failure. The system is best suited to design of new, and modification of existing workplaces. It can also be used to assess existing processes and equipment to identify need for modifications in both equipment and procedures.

The industry, with the assistance of the MAPAO, is reviewing the fail-safe process to see if it can be applied to the mining environment. MHSB engineers will be trained in fail-safe principles so they can use this method as a new tool in assessing the design of new and existing mining processes and equipment.

Accident Investigations

Accidents involving critical or fatal injuries and unusual occurrences of a serious nature, are reviewed by MHSB engineering staff to determine whether design changes are necessary to prevent a recurrence. Where appropriate, additional technical analysis or testing is carried out either by Branch staff or consultants to determine cause and engineer out the hazard.

Technical Committees

Branch engineers are active on several technical committees directed toward establishing industry standards, coordinating research and maintaining technical expertise. Branch engineers are active in the following organizations:

Canadian Standards Association Committees:

- Respirators
- Protective Footwear
- Ventilation Ducting
- Hoisting
- Blasting Machines
- Electric Cables
- Fire-retardant Belting and Fluids

Canadian Institute of Mining and Metallurgy Committees

- Rock Mechanics and Strata Control
- Underground Equipment

International Society of Rock Mechanics
Canadian Blaster's Association
OMA Hoisting Committee
MAPAO Subcommittees

- Ground Control
- Hoisting

In addition to the participation on these committees, MHSB staff participate with other agencies, including the US Bureau of Mines, CANMET, and the Federal Department of Energy, Mines and Rresources (EMR) in sharing information and research in areas such as hoisting, ground control and diesel emissions.

Research on Respirators

The Ministry of Labour has provided $452,000 in funding for research into respirators for use in the mining industry. The research is being conducted at Laurentian University by Dr. Brian Kaye. The unique particulate matter associated with smelter flue dusts and the underground environment requires that the effectiveness of current respirators be evaluated.

Wire Rope Testing

The mining regulations require that all mine shaft ropes be tested to destruction before they are installed on a mine hoist. The Wire Rope Testing Laboratory is the only one of its kind in Canada. In 1987 the government announced that this particular Laboratory would be re-located in Sudbury as part of the Miner's Health and Safety Centre.

Technical Studies

Specialists of the MHSB in ground control, working environment, training, mine rescue, electrical and mechanical engineering, provide technical support to the field staff. In instances where additional information is required, technical studies are undertaken. Recent studies include: lighting measurements to determine the minimum light output from a miner's cap lamp, required to identify ground conditions; rockbolt pull tests of various products available on the market; computerized numerical modelling of the stability of mine openings; typical miner exposure to arsenopyrite in gold mines; identifying the problems with sampling for airborne talc particulates; and evaluation of design and operation of loading pockets.

6.2 EDUCATION AND INFORMATION PROGRAMS

Information Sheets

The Branch has an on-going program of producing

explanatory information on the mining regulations. These information sheets explain the intent, origin, and performance objective of the regulations to guide inspectors and workplace parties. Information sheets are produced for all new regulations and modifications to existing ones, which have been processed by the MLRC.

Hazard Alerts
Whenever incidents occur which indicate a potential province-wide hazard, the Branch prepares and circulates a Hazard Alert. This is done either in the form of a letter to the mines or in Hazard Alerts, developed in conjunction with the MAPAO.

Quarterly Reports
The Branch publishes reports of prosecutions, unusual occurrences (near misses) and fatal accidents quarterly. These are sent to clients to assist them in identifying hazards at their workplace.

Regulation Modules
The Branch initiated and managed the production of 39 modules on the regulations for mines and mining plants. These modules were developed with the assistance of the MAPAO, industry and labour.

The modules consist of a manual and audio-visual package. The modules enable a supervisor, joint health and safety committee representative, worker inspector or Ministry inspector to perform a competent inspection. The user will be able to identify pertinent regulations, understand terminology, recognize hazards, apply the appropriate regulation(s) and demonstrate competence in performing an inspection.

Technical Conferences
In the past few years the Branch has sponsored or co-sponsored seminars, facilitating an exchange of information within the mining industry. Recently, a conference on Underground Radio Communications and Lighting, was held at Laurentian University. This event was co-sponsored by the MAPAO, CANMET, and Laurentian University. Two hundred and thirty individuals from across North America participated in this event. Technical experts from Australia and Great Britain, made presentations to the group.

The conference has resulted in a better understanding of the new lighting regulations in Ontario, and identified additional research requirements for underground mine radio communication systems.

Previous seminars have included subject areas such as: rockbursting; rockbolting; mine rescue; and underground bulkheads and dams.

Mine Rescue Training
The Branch's nine mine rescue officers, under the supervision of the Senior Mine Rescue Officer, conduct regular training sessions in fire and non-fire equipment and procedures. These sessions are held at the mine properties, typically in groups of 6 to 10 people. For further details, see section 7.

Section 10 Training
The regulations for mines and mining plants, section 10, requires mines to have training programs in place. These training programs are developed by industry and labour, with assistance from the Ministry of Skills Development and the MOL. The training program is in a modular format and results in the worker receiving a certificate upon successful completion.

Programs have been developed in the following: Common Core for Basic Underground Hardrock Mining Skills; Specialty Modules - Underground Hardrock Mining; Common Core for First Line Production Supervisors - Underground Hardrock Mining; Common Core for Basic Underground Soft Rock Mining Skills; and Specialty Modules - Underground Soft Rock Mining.

The Burkett Report concluded that accidents sustained by young and inexperienced miners had been reduced by 21% since the inception of the common core modular training program, which is an indication of the impact of proper training on mine safety.

Guidance to Employers and Workers
The Branch visits client groups upon request for the purpose of explaining the role of the inspectorate, intent of regulations, and policies of the Branch. In 1987 Branch staff spent about five per cent of their time helping the workplace parties co-operate in complying with the Regulations.

Presentations to Safety Groups, Technical Societies and Unions
MHSB staff regularly make formal presentations at various training or educational institutions. The audiences vary from college or university students, to workers, joint health and safety committee members and technical specialists.

During 1987, Branch staff taught: ground control at Haileybury, Cambrian College, Laurentian University and the University of Toronto; ventilation at Haileybury; and mine rescue at two colleges and universities.

In addition, formal presentations have been made to union membership on the monitoring of contaminants in the workplace.

Centre for Ground Control Training (Cambrian College)

The MOL has awarded $403,000 to Cambrian College to set up a centre for ground control training in Sudbury. This centre will set up training programs for miners, maintenance workers, supervisors, health and safety representatives, inspectors, ground control technicians and technologists.

The training programs will consist of various modules, incorporating state-of-the-art audio-visual materials that will be tailored to each mine's specific requirements. Portions of this program are designed for distance educating format, as opposed to requiring people to travel to the college.

Chairs in Rock Mechanics and Ground Control

The Ontario government has established a chair in rock mechanics and ground control at Laurentian University, with cross-assignment to Queen's University. A second chair is also being established at Queen's. In addition, the mining industry (Placer-Dome) has funded a third chair in rock mechanics at the University of Toronto.

6.3 ENFORCEMENT

Role and Action of Inspector in the Workplace

Inspectors of the MHSB audit mines to evaluate how well workplace parties are controlling risk in the workplace. This activity consists of targeted inspections, audits of records, workplace monitoring, consultation with joint health and safety committee representatives and investigation of accidents and complaints. The circumstances under which inspections are conducted and the determination of when orders are to be issued or prosecutions undertaken are specified in policies and proc edures developed by the Occupational Health and Safety Division. These are public documents, and will be supplied to the Standing Committee on request.

Inspections

MHSB inspectors carry out inspections of the workplace with the accompaniment of a worker representative of the joint health and safety committee, and the employer. During the inspection, the inspection group assesses work practices and conditions, and identifies any hazards.

Violations of the mining regulations are noted and verbal orders are given to correct any hazard. At the conclusion of the inspection, the findings are reviewed with the worker and employer representatives.

Orders

All verbal orders are confirmed in writing at the conclusion of an inspection. In the order, the nature of the violation, location, time-frame for compliance, and possible means for achieving compliance are itemized.

The employer is required to post a copy of the orders and provide a copy to the joint health and safety committee.

Upon the completion of any work pursuant to a written order of an inspector, the employer is required to notify the MHSB in writing, of the completion of the work. (Section 5(4) of the Regulations).

Stop Work Orders

If during an inspection serious violations of the regulations which present immediate hazard to workers are found, the inspector will issue a Stop Work Order. All workers are removed from the workplace. The only work permitted is that of a remedial nature. In addition, it is the policy of MOL that before work can resume in a workplace at which a Stop Work Order was issued an inspector must re-inspect the site, and release the scene, in writing.

Work Refusals

Section 23 of the Act, provides for the right of a worker to refuse to perform unsafe work.

The legislation establishes an investigative mechanism whereby the employer and worker representatives have an opportunity to resolve the reason for the work refusal. If this internal process is unsuccessful, an inspector of the MOL is required to carry out an investigation and decide whether the situation does constitute a hazard to the worker.

Prosecutions

Prosecutions are considered in cases of flagrant violations of the regulations, non-compliance with an order of an inspector, and critical and fatal accidents. Prosecution investigations must be thorough, entailing a gathering of both physical evidence and statements from witnesses.

Complaints

MHSB staff receive either verbal or written complaints from workers, unions, joint health and safety committee members or employers.

All complaints are investigated and where appropriate enforcement is initiated. Branch staff, on the average spend three per cent of their time dealing with complaints.

Accident Investigations

Employers are required to report all medical aid and lost-time accidents to the MHSB. Employers usually forward a copy of the WCB Form 7, to the Branch's District Offices.

The "Form 7s" are coded for input into a computer database, maintained by the Ministry. In addition, all reports are reviewed by the field staff to identify serious hazards which may require follow-up.

All critical and fatal accidents are thoroughly investigated, entailing the gathering of statements from witnesses, on-site observations, and special testing where appropriate.

Section 7
Emergency Preparedness and Mine Rescue

As a result of the Stevenson Inquiry, the MHSB has taken several steps to improve emergency preparedness at Ontario mines.

A new regulation addressing First-Aid in underground mines was recommended by the Mining Legislative Review Committee at the February, 1988 meeting. This proposed regulation would require upgraded training of first-aid personnel, improved first-aid facilities, and equipment for transportation and rescue of injured workers. The recommendation will be forwarded to the Workers' Compensation Board, which administers the First Aid Regulation under the Workers' Compensation Act.

In addition, the Branch has prepared a Crisis Management Program manual. The manual is designed to assist employers in assessing and improving their emergency preparedness organization. The program was developed from information obtained about operation CATAMINE, in Quebec, the United States, and the Ontario Mine Rescue Organization.

This program will be circulated to the mining industry, in early 1988, and involves the compilation of a resources manual and databank that indicates the location of specialized equipment that may be required in an emergency.

2.1 MINE RESCUE

Mine rescue stations and training programs were introduced following a disastrous underground mine fire at the Hollinger Mine, in 1928 in Timmins; 39 miners died of asphyxiation.

Following a Royal Commission into the tragedy, the first mine rescue station was established in Timmins in 1929. Since that time six more main stations and 42 substations have been added. Figure 7.1 shows the location of mine rescue facilities.

The Mine Rescue Organization provides standardized training in fire and non-fire mine emergency procedures and equipment. In addition, the organization provides a source of some unique equipment, such as: breathing apparatus, fire-fighting and non-fire equipment. This equipment is dispersed throughout the province.

In 1987 there were 805 mine rescue workers under active training, which consists of a minimum of six training days per year per person. The quality of the training is evaluated during a series of district and provincial competitions, held annually.

The release of the Stevenson Report has accelerated the purchase of non-fire equipment for the organization. In the past two years, this has amounted to capital expenditures of a quarter of a million dollars.

In 1987, there were 88 underground mine fires reported to the MHSB, of which 11 required the services of mine rescue teams.

The cost of maintaining the Mine Rescue Organization and the cost of equipment is paid by a direct levy assessed against mining operations, in much the same way as the Workers Compensation Fund is funded by assessments against companies.

Figure 7.1
Location of mine rescue facilities in Ontario

o - main stations
x - sub stations

Section 8
Future Directions and Initiatives

The measures taken so far to reduce accidents in Ontario Mines have been successful, to the extent that overall accident rates have been falling for the past 15 years. To a large extent, therefore, the Mining Health and Safety Branch will continue to do what it has been doing — only better, we hope. Existing programs will be continued, and improved.

For example, the continuing review of mining regulations and the development of new regulations and standards will continue. The main vehicle for this is the Mining Legislative Review Committee, which will be considering issues related to explosives, first-aid, inspections of loading pockets and shafts, and rockbolting.

Improved training programs also have the potential to dramatically improve health and safety. Consequently the MOL will continue to work closely with the Tripartite Committe on Mining Training to identify areas where training programs can be standardized and certified under section 10 of the Regulations. That Committee is currently reviewing the need for training modules for mill workers, and for mine hoist and diamond drill operators.

In addition to these on-going programs, there are other areas where the MHSB has embarked on new initiatives that are noteworthy, and which should be reflected in lower accident rates in years to come. These are mainly concerned with research and technical support for safety programs, and with information sharing.

8.1 TECHNICAL RESEARCH AND SUPPORT

The Government of Ontario has undertaken the establishment of a Miners' Health and Safety Centre at Laurentian University in Sudbury. This is part of the relocation to Sudbury of the Ministry of Northern Development and Mines, as well as the Mining Health and Safety Branch headquarters staff and Wire Rope Testing Facility. The technical support facilities of the MHSB will be located here, and will provide expertise to field staff in ground control, working environment, electrical, mechanical and mining engineering, and training. The Centre will also serve as a resource centre for mine rescue programs, and will provide specialized equipment and personnel to identify and resolve safety issues.

The Miners' Health and Safety Centre will work in conjunction with the recently-established Mining Research Directorate, a research co-ordinating agency established and funded by the mining industry. The MRD, which is also located at Laurentian University, screens proposed research projects and locates funding for those which are accepted.

The Ministry of Labour will also continue to support co-operative research projects with other jurisdictions. A $4.2 million Rockburst Research Project, now in the third year of a five-year program, hopes to develop a better understanding of the causes of rockbursts and the ways to minimize their impact. It is jointly funded by the Federal and Provincial Governments, and by the mining industry. A second project, developed under the Canada-Ontario Mineral Development Agreement, is devoting $3.2 million to a study of backfill in mines and mine design. It is also in the third year of a five-year program. A third co-operative project , funded by Ontario, Canada and the U.S. Bureau of Mines, is studying hoisting in mines. In addition the MOL will continue to contribute to the efforts of the tripartite Mining Fatalities Committee. It is anticipated that the four research initiatives under-

taken so far — improved accident statistics, fail safe design, a better understanding of the Internal Responsibility System, and a study of the impact of attitudes and culture on safety — will result in either on-going or additional research projects.

8.2 INFORMATION SHARING

Obviously the research projects described above contain a large element of information sharing. In addition the MHSB is co-operating in the National Mining Fatalities Study, which will produce better information on comparative accident rates in Canada, and the causes of those accidents. The MHSB is also co-operating in a national committee to establish a national Mining Incidents Database, which will standardize methods of collecting information, and so remove some of the barriers that now make it difficult to compare accident rates and types in different jurisdictions.

Finally the MHSB will continue to provide information programs, publish research papers, and provide the results of research to all sectors of the mining industry. By strenuously emphasizing the need for better safety programs the number of injuries and deaths in Ontario mines will decrease over time, thereby fulfilling the mission of the Mining Health and Safety Branch.

Mining Health
and Safety Branch
Ministry of Labour

Safety in Ontario Mines

Appendix A
Accident Analysis Report

Ontario Ministry of Labour — Mining Health and Safety Branch

Accident Analysis Report

Document Code (1) [A M] — Accident No. (4) — Current Date (9) [M M Y Y]

Part I — Basic Information

Company Name

Reg. No. (13) — Operation No. (17) — Company No. (22)

Claim No.

Date of Accident (27) [D D M M Y Y]

	Col.	
Name of Injured Person — Last Name	33	
First Name	49	
Body Part	65	
Injury Type	66	
Source of Injury	67	
Accident Type	68	
Source of Accident	69	
Experience in Mining Industry	70	
Experience on this job	73	
Age	76	

Evaluation — Col.

Loss Severity Potential — Major [1] Serious [2] Minor [3] — 78

Recurrence Rate — Frequent [1] Occasional [2] Rare [3] — 79

Description of Accident (Include any specific improper condition and/or improper practice.)

Part II – Immediate Causes

Section 1 – Improper Practices (Why did accident happen?)

Card B

		Major 1	Intermediate 2	Minor 3
Operating without Authority	9	☐	☐	☐
Failure to Warn, Insure or Secure	10	☐	☐	☐
Operating at Improper Speed	11	☐	☐	☐
Making Safety Devices Inoperable	12	☐	☐	☐
Failure to use Safety Device or Equipment	13	☐	☐	☐
Using Equipment Improperly	14	☐	☐	☐
Using Improper/Inadequate/Defective Equipment	15	☐	☐	☐
Failure to use Personal Protective Equipment	16	☐	☐	☐
Improper Loading, Lifting or Placement	17	☐	☐	☐
Taking Improper Position	18	☐	☐	☐
Servicing Equipment in Motion	19	☐	☐	☐
Horseplay	20	☐	☐	☐
Drinking or Drugs	21	☐	☐	☐
Failure to observe	22	☐	☐	☐
Failure to Communicate	23	☐	☐	☐
Failure to Respond Promptly	24	☐	☐	☐
Disobey Instructions	25	☐	☐	☐
Other (Explain):	26	☐	☐	☐

Section 2 – Improper Conditions (Why did accident happen?)

		1	2	3
Guards or Protection	27	☐	☐	☐
Tools, Equipment, Substances	28	☐	☐	☐
Congestion	29	☐	☐	☐
Warning System	30	☐	☐	☐
Fire and Explosion Hazards	31	☐	☐	☐
House Keeping	32	☐	☐	☐
Hazardous Atmospheric Conditions – (Gases, Dusts, Fumes, Vapours)	33	☐	☐	☐
Radiation Exposures	34	☐	☐	☐
Illumination	35	☐	☐	☐
Ventilation	36	☐	☐	☐
Layout of Workplace	37	☐	☐	☐
Noise	38	☐	☐	☐
Other (Explain):	39	☐	☐	☐

Part III – Fundamental Causes (Why were improper practices used or improper conditions created?)

Section 1 – Personal Factors

		Major 1	Intermediate 2	Minor 3
Lack of Knowledge or Skill	40	☐	☐	☐
Lack of Proper Job Training	41	☐	☐	☐
Lack of Proper Safety Training	42	☐	☐	☐
Lack of Safe Job Procedure	43	☐	☐	☐
Dissatisfied with Job Function	44	☐	☐	☐
Risk-taking Personality	45	☐	☐	☐
Physical Body Limitation	46	☐	☐	☐
Pressure from Supervision	47	☐	☐	☐
Self-Urgency	48	☐	☐	☐
Physical/Mental Fatigue	49	☐	☐	☐
Personal Problems	50	☐	☐	☐
Job Security and Prospects	51	☐	☐	☐
Lack of Motivation	52	☐	☐	☐
Abuse of Equipment/Material	53	☐	☐	☐
Other (Explain)	54	☐	☐	☐

Section 2 – Job Factors

		1	2	3
Poor Engineering Design and Layout	55	☐	☐	☐
Lack of Maintenance Services	56	☐	☐	☐
Poor Relationship between Production and Maintenance	57	☐	☐	☐
Lack of General Housekeeping	58	☐	☐	☐
Improper Material Storage	59	☐	☐	☐
Lack of Established Guidelines and Procedures	60	☐	☐	☐
Deviation from Established Guidelines and Procedures	61	☐	☐	☐
Lack of Proper Supervision	62	☐	☐	☐
Production Urgency	63	☐	☐	☐
Lack of Safety Programs, Safety Checks and Reporting Procedures	64	☐	☐	☐
Other (Explain):	65	☐	☐	☐

Directions Issued 66 1 ☐ 2 ☐

Inspection Report No. 67 ☐☐☐☐☐

Part IV — Follow-Up

Section 1 — What action has been or will be taken to prevent recurrences?

A — For Immediate Causes as established in Part II (or short-term corrective action):

B — For Fundamental Causes as established in Part III (or long-term corrective action):

Section 2 — Inspector's Conclusion:

Inspector	Date

Mining Health
and Safety Branch
Ministry of Labour

Safety in Ontario Mines

Appendix B
Recommendations of the Ham Commission

TABLE OF CONTENTS

RECOMMENDATION	PAGE
1.	7
2.	8
3.	8
4.	.23
5.	.23
6.	.11
7.	2
8.	.25
9.	.25
10	.25
11	.18
12	.18
13	.18
14	.18
15	.18
16	.19
17	9
18	.10
19	.23
20	.24
24	.37
25	.38
26	.39
27	.39
28	8
29	.39
30	.40
31	.12
32	.26
33	.14
34	.20
35	.20
36	.20
37	.20
38	.21
39	.13
40	.21
41	.21
42	.21
43	.14
44	.14
45	.14
46	.26
47	.27
48	.27
49	.28
50	.28
51	.29
52	.14
53	.41
54	.42
55	3 and 5
56	.30
57	.15

RECOMMENDATION	PAGE
59	.3
60	.4
61	.4
62	47
63	.4
64	.4
65	.4
66	.5
67	.5
68	.5
69	.5
70	.3
71	44
72	.2
73	44
74	31
75	31
76	31
77	31
78	15
79	.6
80	.6
81	.6
82	32
83	32
84	32
85	33
86	33
87	33
88	45
89	46
90	16
91	34
92	34
93	16
94	16
99	43
100.	35
101.	35
102.	35
103.	36
104.	17
105.	.
106.	36
107.	37
108.	17
109.	36
110.	22
111.	48
112.	48
113.	47
114.	.1
115.	.1
116.	.1

STATUS OF THE RECOMMENDATIONS OF THE ROYAL COMMISSION AS THE HEALTH & SAFETY OF WORKERS IN MINES
(HAM COMMISSION) - JUNE 1980 January 1988

RECOMMENDATION	COMMENTS
GROUP A: POLICY FOR OCCUPATIONAL HEALTH & SAFETY	
The report contains four recommendations relating to the establishment of a health and safety authority and the legislative framework the authority should have.	Re: Recommendation 114 and 115
114* That a Health and Safety in Mines and Mining Plants Act, separate from the Mining Act, be prepared to replace Part IX and the relevant sections of Part XI of the Mining Act and be administered within an Occupational Health and Safety Authority established in the Ministry of Labour (p. 254).	The intent of Recommendations 114, 115 and 116 has been incorporated in the Occupational Health and Safety Act, 1980, a comprehensive piece of legislation which applies to the work population of Ontario at large. Recommendation 117 was adopted by establishing the Occupational Health and Safety Division in the Ministry of Labour in December 1976.
115 That the Health and Safety in Mines and Plants Act consist of a core of general provisions supplemented by regulations the issuance of which is authorized by the Act (p. 254).	
116 That the general provisions of the Health and Safety in Mines and Plants Act identify the duties and responsibilities of the Mines Engineering and Inspection Branch and the Occupational Health and Safety Branch (p. 254)	Re: Recommendation 116 Recommendation 116 requires the identification of the duties and responsibilities of the Branch. The OHSA, 1980 clearly defines the duties and responsibilities of the directors and the inspectors within the Occupational Health and Safety Division.
117 That an Occupational Health and Safety Authority, encompassing the Mines Engineering and Inspection Branch, the corresponding branches under the Industrial Safety Act and the Construction Safety Act, and the Occupational Health and Safety Branch, be established in the Ministry of Labour under an assistant deputy minister (p. 254).	

RECOMMENDATION	COMMENTS
GROUP B: POLICY GUIDELINES FOR THE INTERNAL RESPONSIBILITY SYSTEM	
B.1 Role of Labour and Management at the Industry-Level in the Development of a Regulatory Framework	
7 That the legal framework for the health and safety of workers in mines continue to recognize the importance of a significant component of collective self-regulation by industry as a whole achieved through a Mines Health and Safety Association (p. 46).	Re: Recommendation 7 The Mines Accident Prevention Association of Ontario (MAPAO) is the body that provides collective self-regulation by the industry. MAPAO is constituted under Section 119 of the Worker's Compensation Act, and funds for its operation are collected by the Worker's Compensation Board. The MAPAO provides a wide range of services to its members including: the education of supervisors through the Neil George 5-point system, the conducting of ventilation surveys, carrying out safety audits of companies, the publication of accident and employment statistics for the mining industry for class 5 employees, which represent about two-thirds of the mining population. The MAPAO provides detailed material on their specific activities and accomplishments.
72 That the task groups set up by the Occupational Health and Safety Authority to advise on codes of practice and statutory regulations relating to technological change in mining include representatives of labour (p. 163)	The Mining Act Review Committee was established by Order-In-Council in 1975 before the Ham report was issued. It is a tripartite committee made up of industry, labour and government representatives. The government representatives were non-voting members of the committee. This committee is now called the Mining Legislative Review Committee. It meets regularly and provides advice to the Minister of Labour on the regulation of Ontario mines.

RECOMMENDATIONS

Accidents and Injuries: Review and Definition of Internal Responsibility at the Workplace--Procedures and Policy

55 That management inform the Joint Health and Safety Committee about its policies on rehabilitative work assignment and in the context of independent medical consultation seek the advice of the Committee in giving wise effect to its policies. (p. 121).

59 That the senior management of each mining operation review the performance of its internal-responsibility system, placing special emphasis on the delineation of 1/ responsibility to detect and to report departures from standard conditions at every level of operations, 2/ location of responsibility for ensuring that identified departures are dealt with, 3/procedures for committing the resources to correct anomalies, and 4/ procedures for checking the action already taken and still to be taken. (p. 152)

70 That each mining company provide its employees with a written statement outlining its policy for health and safety and the organizational arrangements and responsibilities for giving effect to it (p. 160).

Re: Recommendations 55, 59 & 70

These recommendations are addressed to the management of mining companies. Their implementation is dependent upon the extent to which senior management is committed to them. Section 14 of the OHSA, 1980 outlines the employer's duties with respect to the workplace, working procedures and equipment. Section 14(2)(a) requires an employer to "provide information, instruction and supervision to a worker to protect the health or safety of the worker". Section 16(2)(b) requires a supervisor to "provide a worker with written instructions as to the measures and procedures to be taken for protection of the worker".

Recommendation 59 suggests that management develop a monitoring program to assess the effectiveness of the internal responsibility system and to determine the corrective action that may be required. The duties and responsibilities of the Joint Health and Safety Committees as outlined in the OHSA, 1980 are sufficiently broad to permit the fulfillment of this recommendation.

RECOMMENDATION	COMMENTS
8.3 Accidents and Injuries: Work Auditors - Their Responsibilities and Procedures	**Re: Recommendation 60, 61, 63, 64 and 65**
60 That statutory provision be made for the appointment in each mine and plant of worker-auditors having the authority an responsibility to examine and report upon conditions of work pertaining to the health and safety of workers at sets of workplaces designated by management in such a way as to encompass all workplaces in underground, open pit, reduction plant, and shop and surface operations (p. 153)	The worker-auditor concept has been incorporated in the OHSA, 1980 in section 8(8). It requires "The members of a committee who represent workers ... (to) ... designate one of the members representing workers inspect the physical condition of the work place, not more often than once a month or at such intervals as a Director may direct." Section 8(8) also says that "it is the duty of the employer and the workers to afford ... (the designated worker) ... such information and assistance as may be required for the purpose of carrying out the inspection." The effectiveness of this provision is being carefully monitored by the Mining Health and Safety Branch of the Ministry.
61 That worker-auditors be given released time with regular wages while performing their duties (p. 154)	
63 That worker-auditors be appointed from among qualified candidates for a period of three years through the collective bargaining unit, where such exists, or be elected by the workers (p. 115)	In addition to the above, several companies and their unions have negotiated and set up worker inspectors. These worker inspectors complement the safety programs by investigating accidents and making inspections much the same as the representatives of the joint health and safety committee.
64 That there be statutory provision for the appropriate worker-auditor to participate in the investigation of fatal accidents and serious injuries (p. 156)	
65 That the designated worker-auditor have the privilege of cross-examining witness at an inquest into any fatal accident whose circumstances he has participated in investigating (p. 156)	The provisions of recommendation 65 are not contained in the legislation. Under the Coroner's Act, at the discretion of the Coroner, any person can be declared a person in standing at an inquest, and thus have the right to question witnesses.

RECOMMENDATION

B.4 Accidents and Injuries: Joint Health and Safety Committees - Establishment and Procedures

66 That there be statutory provision for the establishment of a Joint Labour-Management Health and Safety Committee at each mine and plant (p. 157)

67 That the membership of the Committee consist of equal numbers of persons appointed by management and appointed by members of the collective bargaining unit(s), where such exist, and otherwise elected by the workers collectively, subject to the constraint that at least two of the persons selected be worker-auditors (p. 157)

68 That the Joint Committee conduct its work as far as feasible during regular hours of work and that its members receive their regular wages while engaged on committee work (p. 157)

69 That the Joint Committee meet regularly at least four times per year and not more than once monthly (p. 158)

55 That management inform the Joint Health and Safety Committee about its policies on rehabilitative work assignment and in the context of independent medical consultation seek the advice of the Committee in giving wise effect to its policies. (p. 121)

COMMENTS

Re: Recommendations 66, 67, 68, 69 and 55

The legislation fully meets the recommendations of the Report. Indeed, the provisions of the OHSA, 1980 with respect to the Joint Health and Safety Committees go beyond the report. Section 8 of the Act stipulates the requirements for the composition, powers and responsibilities of the Joint Health and Safety Committees. In addition, it requires that the members of the committees be paid appropriately for time spent carrying out their duties.

RECOMMENDATION

B.5 Accidents and Injuries: Examination of Work Conditions and Equipment Deemed Unsafe

79 That section 169(16)(b) be amended (and be included in a revised Act, to be recommended) to require the supervisor to make a written report which: 1/ states the nature of the condition of the machine or device which in the worker's belief renders it unsafe for use; 2/ gives the supervisor's comments at the time; and 3/ gives the supervisor's confirmation or otherwise that section 169(15) is, in the supervisor's view, satisfied (p. 176)

80 That the worker who refers a machine or device to his supervisor under section 169(16)(b) as amended sign and receive a copy of the supervisor's report (p. 177)

81 That where a worker after due consultation with his immediate supervisor, believes that the work then assigned cannot be performed by standard procedures without encountering personal risks deemed by him to be unreasonable, there be a statutory requirement that the work situation be examined and judged by a member of senior supervision in the presence of a worker-auditor acting as an observer and that a report of the circumstances be made to the mines inspectorate by the manager (p. 178)

COMMENTS

Re: Recommendations 79, 80 and 81

The OHSA, 1980, Section 23 and 24, details the procedures for the examination and determination of work conditions believed to be unsafe, and also details the procedures for investigation of the circumstances by the supervisor and the inspector. Although the Ham Report did not recommend that a statutory right to refuse to perform unsafe work be established, the Act does provide the right and provides for final adjudication of disputed claims involving the exercise of that right. The legislation is quite specific as to the procedures to be followed when a worker believes an unsafe condition exists (See Section 23, particularly subsection (3) to (1) inclusive).

Section 16(2)(b) requires that written instructions regarding measures and procedures to protect the work and the work place be provided where prescribed.

RECOMMENDATION

GROUP C: STUDIES AND RESEARCH

C.1 Silicosis and Dust

REVIEW OF HEALTH STATUS OF EXPOSED WORKERS

1 That the Occupational Health and Safety Branch of the province conduct or have conducted and publish on a regular cycle not exceeding five years status reports on the evolution of occupational diseases among miners (p. 32).

COMMENTS

General Observation

Since the Ham Report was published, the Federal Parliament has assumed jurisdiction over occupational health and safety in uranium mines and plants, and the review of the health status of uranium mines has become a federal responsibility. The Worker's Compensation Board has statutory responsibility for studies and activities pertaining to compensability and rehabilitation efforts.

Re: Recommendation 1

The first report of this type was published in 1975 and dealt almost entirely with respiratory disease. A study of the evolution of occupational diseases among miners is being done by the Ministry and the Worker's Compensation Board. See also comment on Recommendation 17 below.

1982	Muir study commences, due for completion in 1988
1983	Part I - "Study of Mortality of Ontario Miners 1955-1977" released by Dr. Jan Muller.
1986	Part II released
1986	Silicosis study of surface workers released, Special Studies by Dr. Finklestein

RECOMMENDATION	COMMENTS
2 That the radiological status of silicosis in the dust-exposed population currently employed in the Elliot Lake uranium mines and all other uranium mines be reviewed by the Occupational Health and Safety Branch on a biennial basis for a period of at least ten years (p. 33)	Re: Recommendation 2 Dust exposed uranium miners are examined on a regular basis by the Ministry's Chest Clinic. Results of these examinations are reported to the Workmen's Compensation Board with special attention being given to those who show early signs of dust effects or more advanced X-ray changes which may be classified as silicosis. The WCB can therefore, at any time, indicate the number of current employees whose X-rays reveal dust effects. 1987 Dr. Muller: Addendum to Mortality Study dealing solely with uranium mining in the province 1955 - 1977 To be released publicly in near future.
3 That the radiological status of silicosis among the persons on record on the Uranium Nominal Roll be reviewed on a biennial basis for a period of at least ten years (p. 33)	Re: Recommendation 3 This recommendation has not yet been implemented. Workers whose X-rays exhibit signs of silicosis may not necessarily have any respiratory disability, but they may submit claims to the WCB, nevertheless. Those who submit claims are entitled to periodic reviews of their situation. Routine follow-ups of miners who show no evidence of dust-related disease at the time of leaving employment have not yet been implemented.
28 That the Occupational Health and Safety Branch commission research on the radiographic records related to Miner's Certificates to assess the relative rate of progression of persons in and out of dust (p. 59)	Re: Recommendation 28 This has been carried out as part of the Ontario Miners Study. The records of miners who develop silicosis were reviewed with particular reference to the sequential changes in their X-rays. From these studies information was obtained about the relative rate of progression of the condition in persons in and out of dust.

RECOMMENDATION	COMMENTS
C.2 Silicosis and Dust: Studies of Environmental Conditions, and Research for the Establishment of Standards	
17 That to provide a basis for establishing a statutory standard or standards for time-weighted average respirable dust exposure in Ontario mines and plants, the Occupational Health and Safety Branch commission epidemiological research on the relation of the incidence of silicosis and of other pulmonary effects to the structure and quantity of aerosols respired in Ontario mines (p. 53)	Re: Recommendation 17 The Ministry in conjunction with the mining companies has provided financial support to Dr. David Muir of McMaster University to conduct a study of this project. The report is due in mid-1988. It is hoped that sufficient data will be available to allow a correlation of exposure records with the observed X-ray evidence. Ontario has a collection of thousands of X-rays of dust-exposed miners. Dr. Muir, with the assistance of a group of experts, has re-read approximately five thousand X-rays and re-classified them in accordance with current international diagnostic criteria. The objective will be to determine whether there is a differential rate of progression of disease dependent on the quantity of aerosol to which the miners are exposed.

RECOMMENDATION

18 That where more than one recognized toxic component is present in the aerosols the standard specify how an effective combined exposure limit is to be determined (p. 53)

COMMENTS

Re: Recommendation 18

O/Reg 654/86 (1986) Exposures to Biological or Chemical Agents has "mixture formula" included. However, the hazardous substances must have similar toxilogical effects (i.e. effect the same target organ(s)), and must effect the individual over a similar time period. In practical terms, therefore, combined exposure limits are rarely used.

The International Commission on Radiological Protection does combine the effects of all radionuclides (alpha, beta, gamma, from dusts, gases) and sets a maximum annual exposure limit of 50 mSv, which has been adopted by the AECB.

O/Reg 654/86 resulted in changes to the mining regulations to adopt the 1986-1987 ACGIH TLV booklet for those chemical and physical agents not covered by 654/86.

Ian French & Associates were retained by CANMET to develop an air quality index for diesel fumes. This formula is not practical to use on a day-to-day basis but it is used by CANMET in assessing alternate diesel control strategies.

RECOMMENDATION

6 That the Occupational Health and Safety Authority publish at least biennially a critical review of its appraisal of environmental conditions at the workplaces in the mines and mineral plants (p. 43)

COMMENTS

Re: Recommendation 6

This has not been done. This report would be useful, only if it showed the trends of the environmental conditions at each mining plant or mine. A report showing this data by type of ore mined, or geographical area would not really be helpful in targeting those mines with poor workplace environment.

All data, MH&SB, companies and MAPAO should be placed on a common data base, using internationally recognized job codes and classes. This data base could then be used to check trends among drillers, or equipment operators, as well as between mines with similar mining conditions. If required, a biennial report could be produced.

Presently the MH&SB is placing all its radon & thoron daughter results on a data base to analyze trends and/or problems in all the non-uranium mines. Similar data bases will be developed for silica and other airborne contaminants.

RECOMMENDATION

C.3 Lung Cancer and Ionizing Radiation: AECB Radiation Measurements and Effects, Research, and Provincial Occupational Health Records Review

31 That the Atomic Energy Control Board confirm the extent to which thoron gas and its daughter products contribute to the irradiation of the respiratory system and other organs of workers in Ontario uranium mines (p. 68)

37 That the Atomic Energy Control Board 1/ have research conducted relevant to current circumstances a/ on means for measuring all components of ionizing radiation effective in contributing significantly to the irradiation of the lungs, other organs, and tissues of workers in Ontario uranium and thorium mines and mills; and b/ on the spatial and temporal distribution of ionizing radiation and related particulates in these mines and mills; 3/ facilitate, with the assistance of the federal Department of Health and Welfare, epidemiological research on a national basis (p. 86)

COMMENTS

Re: Recommendation 31 & 37

The AECB currently regulates thoron daughters to 12 WLM/yr maximum. If found in the presence of radon daughters and gamma radiation then the allowable exposure will be considerably less. The sum of adsorbed dose from all forms of radionuclides cannot exceed 59 mSv/yr.

1986 O/Reg. 632/86 designated X-rays as a controlled substance. Presently the Ministry is developing a regulation for radionuclides not covered under AECB jurisdiction. In addition, regulations are being developed for radon daughters in underground operations.

Re: Recommendation 37

AECB has commissioned several research projects.

RECOMMENDATION	COMMENTS
39 That the Occupational Health and Safety Branch be assigned by provincial statute the responsibility to direct: 1/ the establishment and review of occupational health records for workers in uranium and thorium mines and mills, for regulatory and epidemiological purposes;	Re: Recommendation 39 AECB requires all uranium mining companies to maintain records of a worker's exposure to radon daughters and gamma radiation. As well, companies must monitor for thoron daughters, uranium and other radionuclide dusts. In the non-uranium mines the Ministry is presently developing regulations for radon daughters which will include record keeping.

RECOMMENDATION

COMMENTS

C.4 Lung Cancer and Ionizing Radiation: Epidemiological Studies on Causes and Effects of Irradiation and Mortality Experience

33 That the Occupational Health and Safety Branch commission a review of the mortality experience of persons on the Ontario Uranium Nominal Roll on a biennial basis for at least ten years (p. 80)

43 That the Occupational Health and Safety Branch commission a study of the mortality experience of the Ontario Uranium Nominal Roll relative to appropriately matched sample populations of non-uranium miners and non-miners in Ontario (p. 91)

44 That the Occupational Health and Safety Authority of the province, in collaboration with the Atomic Energy Control Board, have conducted further epidemiological research based on the exposure to ionizing radiation among Ontario uranium miners (p. 96)

45 That the epidemiological research include a study of 1/ the amount and type of exposure effective in raising cancer mortality, 2/ the pathology of lung cancer in miners, and 3/ the effects of cigarette smoking and of other conjoint occupational factors (p. 96)

Re: Recommendations 33, 43, 44 and 45

Recommendations 33, 43, 44 and 45 are covered by Dr. Muller's. Dr Muir's and Dr. Finklestein's respective studies, as described under the comments on Recommendations #1 and 17.

In Dr. Muller's study the cohort covered the years 1955 to 1977. Discussions are taking place regarding the extension of this study to include the 10 years from 1977 to 1987.

52 That tests using sputum cytology be conducted every two years on all persons who have worked in radiation exposure at the uranium mines for five or more years (p. 108)

Re: Recommendation 52

Apparently, the risk of infection from the procedure has resulted in an arrangement where it is available to workers on a voluntary basis.

RECOMMENDATION	COMMENTS
C.5 Accidents and Injuries: Studies of Accident and Injury Risk Factors and the Reporting Procedures	
57 That the Occupational Health and Safety Branch publish biennially a critical review of factors that influence risks of accident and injury at workplaces in the mines and mineral plants (p. 130)	Re: Recommendations 57 & 58 A statistical report of mining accidents is prepared by the Ministry on an annual basis. The MAPAO publishes injury statistics on all mining companies on a monthly basis, with each company's frequency for lost time and medical aid injuries. There are breakdowns on type of work, age, time of day, etc., and these are analyzed to determine whether there are any links. Injuries to persons working alone are also assessed.
58 That the Occupational Health and Safety Authority, in consultation with the Worker's Compensation Board, industry and labour, review the procedures for the reporting of injuries and accidents with a view to establishing links to occupational records and thereby facilitating accident research by sample methods (p. 145)	
78 That all fatalities and serious injuries to persons working along underground be the subject of biennial review by the Occupational Health and Safety Branch (p. 175)	Re: Recommendation 78 All mining fatalities and serious accidents are fully investigated by the Mining Health and Safety Branch. The legislative requirement for reporting accidents is contained in Section 25 of the OHSA, 1980, and in Section 20 of Ontario Regulation, 714/82. The "working alone" fatalities are investigated in the same manner as the other fatalities, but they have not yet been subjected to the biennial review as described in the recommendation.

RECOMMENDATION

C.6 Toxic Substances: Studies of Hazardous Exposure Patterns and Effects

90 That profiles of risk-encounter for toxic substances be developed by examining the work patterns of maintenance workers, and that modular training be adapted to such profiles (p. 206)

93 That at five-year intervals the Occupational Health and Safety Branch commission a review of the status of the health of samples of persons who are at high risk from acute encounters with toxic substances, including as necessary intensive medical surveillance (p. 207)

94 That epidemiological reviews of selected populations subject to chronic exposure to toxic substances in reduction plants and mines matched to suitable control groups be conducted on a five-year cycle by or under the guidance of the Occupational Health and Safety Branch and that the essential results of such studies be summarized and published upon completion (p. 212)

COMMENTS

Re: Recommendations 90, 93 and 94

Training modules have been developed by the Branch covering subjects such as hazardous materials, maintenance practices, concentrators, smelters and refineries. These modules describe potential hazards and the means for overcoming them.

Regulation 694 section 259(b) requires records to be kept of injuries from chemical reagents.

The Ministry has produced a series of Designated Substance Regulations. An open consultative process was used during the development of the regulations including a study of the available information on health effects and typical exposures. Regulations now exist for substances such as lead, mercury, arsenic and silica.

RECOMMENDATION

C.7 Noise: Studies of Noise Levels and Effects on Exposed Workers

104 That the mining industry, in cooperation with labour and the Occupational Health and Safety Authority, have conducted research to determine shift-profiles of noise encounter for representative occupations in mines and plants both in the absence and in the presence of actual and best-available hearing protection, that such profiles be codified and published, and that a code be assigned to each worker who regularly encounters areas of work in which noise levels of 85 dB(A) or higher exist (p. 230)

108 The Occupational Health and Safety Branch commission on a five-year cycle statistical assessments of the state of hearing among sample populations of workers in mines, and that the first review be of production crews in underground operations, including diesel operators (p. 232)

COMMENTS

Re: Recommendations 104 & 108

Noise surveys have been carried out by the Branch as well as by various mining companies.

Also, specific studies into noise have been made by CANMET and by Ontario Hydro on selected groups of workers. Considerable published information is available on noise and the effectiveness of various types of hearing protection.

The Branch has adopted 85 dBA over 8 hours as the standard. However, there does not appear to be any practical method of control other than by hearing protection and audiometric testing of workers. These measures are the responsibility of the employers. The mining industry in general has effective hearing conservation programs in place.

RECOMMENDATION	COMMENTS
SECTION D: STANDARDS, GUIDELINES AND CODES OF PRACTICE	
D.1 Silicosis and Dust: The Establishment of Interim TLV's and Future Standards for Free-Silica Dust Levels	
11 That the Occupational Health and Safety Authority establish by regulation a dust standard for personal exposure to free silica in mine and plant aerosols based on a time-weighted average of respirable dust intensity over a working shift and a stipulated lifetime period of exposure (p. 50)	Re: Recommendations 11, 12, 13 and 15 These have been legislated under the Designated Substance Regulations for Silica (O/Reg 769/83)
12 That the dust standard for time-weighted average exposure be established on a statutory basis (p. 50)	
13 That the Occupational Health and Safety Authority immediately establish by regulation an interim threshold limit value (TLV) for the mass of respirable free silica in milligrams per cubic metre (p 51)	
14 That the interim TLV have the status accorded by the Occupational Health and Safety Authority to threshold limit values as issued by the American Conference of Governmental Industrial Hygienists (p. 51)	Re: Recommendation 14 The TLV has been set at 0.2 mg/m^3 maximum, with a view to achieving 0.1 mg/m^3.
15 That the Occupational Health and Safety Branch prepare a code of requirements for the gravimetric measurement of dust in all mines suited to determining personal exposure to dust (p. 51)	

RECOMMENDATION	COMMENTS
16 That all steps necessary to render effective a gravimetric standard of dust measurement, including those listed herein, be implemented immediately (p. 51)	Re: Recommendation 16 The Code for Measuring Airborne Silica, which includes the analytical method for the determination of cristobalite and alpha quartz on air sampling filters, dated October 17, 1983, came into force with the passage of the designation of silica, December 9, 1983.

RECOMMENDATION	COMMENTS
B.2 Lung Cancer and Ionizing Radiation: Review & Development of AECB Regulatory Framework	These recommendations are addressed to the AECB, which has jurisdiction over radiation in uranium mining. The province is represented on an advisory committee which considers these problems.
34 That the Atomic Energy Control Board review the basis for and issue explicit regulations establishing the maximum permissible annual exposure to ionizing radiation for workers in uranium and thorium mines and mills (p. 86)	Re: Recommendations 34, 35 and 36 Schedule 11 of Section 19 of the Atomic Energy Control Regulations, issued on January 12, 1978, limits the exposure of atomic radiation workers to radon daughters to 4 WLM (Working Level Months) per year and to 2 WLM per quarter. This section also specifies the maximum allowable exposure to ionizing radiation at 50 mSμ/yr, based on ICRP.
35 That the regulations for maximum permissible exposure delineate how all significant components of external and internal irradiation are to be accounted for and indicate how total exposure and related dose is to be evaluated (p. 86)	
36 That the regulations for maximum permissible exposure and related dose to be interpreted in units that can be monitored by practical means in uranium and thorium mines and mills (p. 86)	
37 That the Atomic Energy Control Board 2/ issue codes of guidance a/ for the frequency and location of sampling required to determine both the radiation exposure of individual workers in Ontario mines and mills and the general state of the mine and mill environment; b/ for the selection, use, maintenance, and calibration of instruments for measuring ionizing radiation both for the determination of individual exposures and for the monitoring of the general mine and mill environment; c/ for the identification of persons for whom records of radiation exposure should be kept; and d/ for the form, preservation, and use of occupational records for exposure to all significant components of ionizing radiation;	Re: Recommendation 37 In Section 11 of the Atomic Energy Control Regulations, licensees are required to keep records which allow a worker's radiation exposure to be determined. Each mine develops a code of practice which is approved by the AECB.

RECOMMENDATION	COMMENTS
D.3 Lung Cancer and Ionizing Radiation: Development of Ontario Regulatory Framework	Re: Recommendation 38, 40, 41, 42
38 That the Province of Ontario, through the Occupational Health and Safety Authority, establish by statute a standard for maximum permissible annual exposure to ionizing radiation for workers in uranium and thorium mines and mills, and that this standard be in conformity with the regulatory standards of the Atomic Energy Control Board (p. 87)	The province has no authority to deal with the measurement or control of exposure to ionizing radiation in uranium mines. Such matters are the responsibility of the Atomic Energy Control Board.
40 That the Mines Inspection Branch prepare regulations defining the kinds and frequencies of measurements of ventilation, dust and radiation necessary to enable it to audit the engineering operational characteristics of uranium and thorium mines and mills (p. 88)	The Ministry is developing a regulation to cover those radionuclides which are not presently under the jurisdiction of the AECB.
41 That these regulations be in conformity with the related code of guidance established by the Atomic Energy Control Board (p. 88)	
42 That the Occupational Health and Safety Authority specify 1/ a level of radiation in mine or mill air measured at any time in any occupied workplace which, if exceeded, requires that corrective action be taken immediately; 2/ a level of radiation in mine or mill air measured at any time in any occupied workplace which, if exceeded, requires closure of the related workplace until the level of radiation is reduced below that specified in 1 (p. 88)	

RECOMMENDATION

D.5 Noise and Toxic Substances: Development of a Regulatory Framework for the Control of Noise and Toxic Substances

110 That the Occupational Health and Safety Authority be assigned by statute the responsibility to establish standards or guidelines for personal exposure to all toxic substances and hazardous physical agents and that, subject to any statutory standards and in consultation with industry and labour, the Authority issue a code of practice for the application in mines and plants of the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists (p. 235)

COMMENTS

Re: Recommendation 110

Section 41(14) of the OHSA, 1980, provides statutory authority for the Ministry of Labour to declare certain substances as designated substances and to regulate their use. Further, Section 20(1) provides authority for the Director of the Mining Health and Safety Branch to control the use of toxic substances which have not been designated under Section 41(14).

Substances which have been legislated as Designated Substances follows:

Date	O/Reg	Substance
1981	536/81	Lead
1982	141/82	Mercury
	516/82	Vinyl Chloride
	517/82	Coke Oven Emissions
	570/82	Asbestos
1983	769/83	Silica
	455/83	Isocyanates
1984	733/84	Acrylonitrile
	732/84	Benzene
1986	654/85	Asbestos - Construction Projects
	176/86	Arsenic
	632/86	X-Rays
	654/86	Biological & Chemical Agents (TLV's)
1987	146/87	Ethylene Oxide
	23/87	All DSR's amended 40 hrs/week and 8 hours day

RECOMMENDATION

E.1 Silicosis and Dust: Measurement of and Reporting on Environmental Monitoring

4 That the functional purpose, measuring procedures, and measured results relating to all environmental monitoring at the workplace be made known in understandable language to all affected workers and their representatives by the employer and as appropriate by the Mine Inspection Branch (p. 40)

5 That the Mines Inspection Branch within the Occupational Health and Safety Authority conduct annually, or have conducted by an independent agency, sample measurements at representative workplaces of all environmental quantities whose values are audited by the branch in carrying out its role (p. 43)

19 That the existing code of requirements for dust measurement in the uranium mines as issued by the chief engineer of the Mines Engineering Branch remain in force (p. 53)

COMMENTS

Re: Recommendation 4

All these points are addressed in the Designated Substance Regulations on Silica (O/Reg 769/83).

Re: Recommendation 5

The Designated Substance Regulations place this responsibility on the companies. Normally problem areas/substances are monitored more frequently to determine worker exposures and evaluate effectiveness of controls.

The Branch does not have the resources to conduct routine mine-wide sampling. However, the Ministry does take measurements in problem areas and audits the results of company sampling.

Re: Recommendation 19

This recommendation has been rendered obsolete by the Silica Regulations.

RECOMMENDATION

20 That the system of measurement and reporting being conducted by the Mines Accident Prevention Association continue in operation and be subject to independent monitoring as recommended (p. 54)

COMMENTS

Re: Recommendation 20

The Mining Health and Safety Branch does not audit the konimetry measurements conducted by the Mines Accident Prevention Association of Ontario as this technique has been superceded by the gravimetric sampling technique, and is now used only for purposes of monitoring the effectiveness of engineering controls.

The MAPAO is endeavouring to have the companies continue a system of measurement and reporting, modified to apply to gravimetric techniques. This is considered most important for the continued success in the control of silicosis.

As described previously, the silica regulation requires mines to carry out work place monitoring.

RECOMMENDATION	COMMENTS
E.2 Silicosis and Dust: Codes and Schemes of Practice for Dust-Control and Ventilation	
8 That the Mines Inspection Branch within the Occupational Health and Safety Authority, in consultation with industry and the representatives of workers, prepare, under clearly defined statutory authority, CODES OF PRACTICE applicable to all mines relating to: 1/ the prevention and confinement of dust at each distinctive class of workplace; 2/ the provision of ventilation in the breathing zone of workers that is effective for purposes of protecting health and each distinctive class of workplace (including vehicles) (p. 49)	Re: Recommendation 8 The Ministry of Labour has adopted a policy regarding codes of practice. Regulations specify performance criteria: the focus is on what is to be accomplished. The way in which the required result is achieved is the responsibility of the employer. However, the Act does permit the establishment of codes of practice by regulation. Specific codes of practice are contained in Ontario Regulation 660/79 (sections 242, 243, 244, 245, 247, 248, 255, 256 and 282). In addition, the Threshold Limit Values (TLV) for Chemical Substances and Physical Agents of the American Conference of Governmental Hygienists (ACGIH) are adopted as guides.
9 That the management of each mining operation or appropriate part thereof be required under clearly defined statutory authority to prepare and keep updated A SCHEME OF PRACTICE for implementing the foregoing codes (p. 49)	Section 14 of the Act requires the employer to provide "measures and procedures" for the worker where prescribed and Section 16 requires supervisors to ensure that these practices are used.
10 That the management be required to appoint a competent person to supervise the over-all operation of the scheme (p. 49)	The Act requires that supervisors be "competent", (See Sections 14(1)(c), 14(2)(b), 14(2)(c), 14(3) and 16.)

RECOMMENDATION	COMMENTS
E.3 Lung Cancer and Ionizing Radiation: Monitoring and Auditing Radiation Levels and Ventilation Systems	
32 That the Occupational Health and Safety Authority be given by statute the authority and responsibility to conduct a full and expeditious review of any emergent situation in which the health and safety of workers in mines are believed to be at unexpected risk (p. 78)	Re: Recommendation 32 The inspector is provided with wide and effective powers under Section 28 and 29 of the OHSA, 1980 to deal with any situation which may place the health and safety of workers at risk. The director is given additional authority with respect to toxic substances in Section 20, and under the Designated Substance Regulations.
39 That the Occupational Health and Safety Branch be assigned by provincial statute the responsibility to direct: 2) the preparation of a code of practice for the sampling and measurement of ionizing radiation in a manner suited to the determination of the exposures of individual workers in uranium and thorium mines and mills and that this code of practice be in conformity with the code of guidance issued by the Atomic Energy Control Board (p. 87)	Re: Recommendation 39 Exposure to ionizing radiation is dealt with in Regulation 19 pursuant to the Atomic Energy Control Act. Since the jurisdiction is exclusively federal, the province has no authority to implement this recommendation. The Ministry is developing a regulation to cover those radionuclides which are not presently under the jurisdiction of the AECB.
46 That persons who work in exposure to ionizing radiation in uranium mines cease smoking both at home and at work for their own sakes and in consideration of their families (p. 96)	Re: Recommendation 46 This recommendation relates to the Federal Regulation and is therefore not within the jurisdiction of the provinces. However, smoking is prohibited by company rules in uranium mines.

RECOMMENDATION	COMMENTS
47 That each uranium mine install a central monitoring system for its ventilation network to monitor air flow and air quality as indicated by dust, radiation, and other contaminants (p. 102)	Re: Recommendation 47 Air monitoring systems have been installed at both Rio Algom and Denison Mines, but problems have been found due to unreliability in the harsh underground conditions. Also, similar systems have been installed at other mines, though similar problems have hindered widespread use of this technology.
48 That the Mines Inspection Branch audit the engineering records of performance of mine ventilation systems (p. 102)	Re: Recommendation 48 Ventilation audits are done by inspectors on their routine inspections. Section 243(2) of O/Reg 660/80, requires that detailed records be kept of the mine ventilation system performance, for review by an inspector.

RECOMMENDATION	COMMENTS
E.4 Silicosis, Dust, Lung Cancer and Ionizing Radiation: Job Rotation and Record Maintenance	
23 That any employer who rotates job assignments for workmen with the intent of limiting the occupational exposure of any persons to any hazardous environmental condition be required to obtain the formal approval of the Occupational Health and Safety Branch and to maintain permanent occupational records which clearly define the persons, tasks, locations, hazardous conditions, and time intervals involves (p. 57)	Re: Recommendation 23 The general requirement for keeping records of workers' exposure to hazardous substances is contained in Section 15(1)(d) of the OHSA, 1980. Job rotation is permitted to control a workers' exposure where engineering controls are not practical.
49 That job rotation within mines conducted to meet the standard for maximum permissible annual exposure to ionizing radiation be permitted only in exceptional circumstances with the explicit approval on a case-by-case basis of the Occupational Health and Safety Branch and with the knowledge of the representatives of the workers (p. 105)	Re: Recommendation 49 Action levels, and the annual and quarterly maximum exposure levels, stipulated by the Atomic Energy Control Board as conditions of licence are designed to control exposure levels.
50 That records of personal exposure to ionizing radiation maintained by the mines be keyed to Miner's Certificate numbers in sequence and to social insurance numbers in sequence and arranged in a format that facilitates linking to the Mining Master File (p. 107)	Re: Recommendation 50 The Mining Master File no longer exists, but has been replaced and up-dated by a more sophisticated computerized record of exposure information on Ontario miners. The Miner's Certificate Number and the Social Insurance Number, when known, are added. Records are maintained by the uranium mines and sent to Radiation Protection Branch, Ottawa.

RECOMMENDATION

51 That the frequency of regular radiographic examination of dust-exposed mine workers be reduced to once every two years unless a radiographic change was apparent at the last examination (p. 107)

Re: Recommendation 51

When silica became a designated substance in 1983 (O/Reg 769/83), the requirements for mandatory dust exposures certificates and X-rays for miners were revoked. Only those mines exposed to concentrations of silica exceeding 0.1 mg/m^3 are on a control program of medical monitoring. Many miners have no requirement for regular medical monitoring. Those mines on medical surveillance are examined every two years.

RECOMMENDATION

E.5 Accidents & Injuries: Pattern of Audits

56 That the Mines Inspection Branch base its patterns of audits in part on studies of the relative risks involved in different segments of mining operations and on the related man-years at risk (p. 128)

COMMENTS

Re: Recommendation 56

Current practice in the Branch now includes a monthly analysis of a company profile, produced by the computerized data record, and a listing of the mining operations and mining companies with the 10 highest accident rates. Problem mines are inspected more frequently.

RECOMMENDATION	COMMENTS
E.6 Accidents and Injuries: Qualifications and Visitation of Persons Working Alone	Re: Recommendation 74, 75, 76 and 77
74 That persons assigned to work alone be required to have specified qualifications for independent work at the job to which they are assigned (p. 174)	These recommendations are addressed in Section 14 of the OHSA, 1980, in general, and by Sections 15 and 252(b) of the Ontario Regulation 660/80 in particular. These recommendations are regarded as standard practice in underground mines and are fully complied with.
75 That on all shifts persons working alone be visited at the place of work at least three times (other than at the start of a shift) by a first-line supervisor (p. 174)	In addition, two recent amendments to the Regulations apply, namely, O/Reg 258/87, Section 62a. re: communications and Section 65a., re: underground lighting.
76 That such visits may be reduced to once per shift (other than at the start of a shift) if 1/ work conditions are standard, and 2/ means of communication are provided and a record of use thereof is kept so that the person working alone reports his status to a point of supervision or to a designated fellow worker not less often than once every two hours (p. 174)	
77 That where the location of work is sufficiently remote to warrant the use of technical means of communication and where no illumination other than that of the miner's cap lamp is normally available, an auxiliary source of illumination powered by means other than the miner's lamp battery be provided at the workplace (p. 175)	

RECOMMENDATION	COMMENTS
E.7 Toxic and Hazardous Substances: Audit of Metallurgical and Other Hazardous Substances	
82 That there be a statutory requirement for a metallurgical audit of origin, holdup, and destination of potentially dangerous minor elements such as lead, mercury, arsenic, selenium, tellurium, cadmium, and antimony to be conducted quarterly in all reduction plants on the basis of extended standard monthly sampling and analytical procedures, and that a copy of this audit be sent to the Occupational Health and Safety Authority (p. 200)	Re: Recommendations 82 and 83 The problems addressed by these recommendations are addressed by Section 20 of the OHSA, 1980 and by Section 257, 258 and 259 of O/Reg. 660/80. Also by OSR O/Reg 654/86 on Chemical and Biological Agents.
83 That there be a statutory requirement for an annual audit of use by mass of toxic and hazardous reagents and that a copy be sent to the Occupational Health and Safety Authority (p. 200)	
84 That pilot plant studies used to develop processes and preliminary operating procedures be extended to an impact on the health and safety of the environment for work (p. 200)	Re: Recommendation 84 See Section 5 of O/Reg. 660/80. The pre-development review procedures applied to new process technology are intended to be broad enough that the intent of the recommendation is fulfilled.

RECOMMENDATION	COMMENTS
E.8 Toxic and Hazardous Substances: Codes and Schemes of Practice for the Use and Control of Chemicals and Toxic Substances	
85 That there be a statutory requirement for each mining company to maintain a register of servicing chemicals involved in any personal encounter associated with a medical aid or compensable injury; that the register specify both trade name and chemical composition and identify all known toxic chemical constituents; that the register include an audit by mass of annual use; and that a copy of this register be provided to the Occupational Health and Safety Authority (p. 204)	Re: Recommendation 85 Recommendation 85 is provided for by Section 15(1) of the OHSA 1978, and by Section 259 (record keeping), Section 260 (reporting) and Section 281 (labelling) of O/Reg 660/80. The provincial and federal governments are putting in regulations on Work place Hazardous Material Information Systems (WHMIS) in 1988 to further address the sale and use of hazardous substances.
86 That there be a statutory requirement for each mining company to give the Occupational Health and Safety Authority notice of intent to introduce any new reagent or servicing chemical whose toxic characteristics are not known (p. 204)	Re: Recommendation 86 Recommendation 86 is provided for in Section 15(1)(e) and Section 21(1) of the OHSA, 1978.
87 That with respect to codes of practice the principles of recommendations 8, 9 and 10 be extended 1/ to the maintenance and operation of mills and metallurgical plants as these activities relate to the leaking and spilling of toxic substances and hot materials into workplaces; 2/ to the handling and use of reagents and servicing chemicals and to the consequences of their leaks and spills (p. 204)	Re: Recommendation 87 This recommendation is intended to deal with molten materials. Section 91 of Ontario Regulation 660/79 responds to it. Sections 257, 258 and 259, together with the various Designated Substance Regulations cover other materials.

RECOMMENDATION	COMMENTS
E.9 Toxic and Hazardous Substances: Monitoring and Recording of Hazardous Exposure	
91 That at any location of regular work where acute encounters with toxic substances repeatedly occur as a result of leaking, recirculating, or spilling from metallurgical and milling processes, there be a statutory requirement for the installation and use of equipment for the continuous monitoring of the substances involved (p. 206)	Re: Recommendation 91 There is no statutory requirement for continuous monitoring of hazardous substances. However, under Section 20(1) of the OHSA, 1978, the Director has the power to order work practices, engineering controls, etc. with respect to toxic substances. Section 15(1)(f) places a duty to monitor on the employer. Several employers have installed continuous monitoring systems for particularly toxic substances such as nickel carbonyl, chlorine and arsine. In addition, Section 242(3) requires that detection equipment shall be available.
92 That a record of the substances and human effects of acute encounters with toxic substances leading to medical aid and compensable injuries be maintained in the occupational health records of each worker at the company level (p. 207)	Re: Recommendation 92 The recommendation places a responsibility on the company management. The OHSA 1980 and Ontario Regulation 660/80 go beyond the recommendation by requiring record-keeping with respect to toxic substances. Section 259 and 260 of the Regulation and the Designated Substance Regulations address many toxic substances.

RECOMMENDATION	COMMENTS
E.10 Diesel Emissions: Codes of Requirements and Practice for Diesel Emissions Control and Ventilation	
100 That the Occupational Health and Safety Authority, in cooperation with the industry and labour, prepare a code of requirements for diesel emissions (p. 222)	Re: Recommendation 100 The TLV's of the ACGIH which have been adopted through Section 279 of Ontario Regulation 654/86 and O.R. 654/86 on Biological and Chemical Agents cover, inter alia, diesel emissions. See also Sections 175, 176 and 243, of the same regulation, governing the ventilation rates to be used underground, where diesel equipment is in use.
101 That the Mines Inspection Branch prepare a code of practice for the provision of ventilation and for the fuelling, operation and maintenance of diesel engines (p. 222)	Re: Recommendations 101 and 102 The codes of practice required under recommendation 101 and 102 are provided for in Sections 114, 115, 175 and 177 of Ontario Regulation 694/80, which cover maintenance, the service and fuelling stations, the keeping of log books and schemes of practice and ventilation.
102 That each mine using diesel equipment be required to file with the Mines Inspection Branch a scheme of practice for the short-term and long-term maintenance of its diesel engines (p. 222)	

RECOMMENDATION

COMMENTS

E.11 Noise: Monitoring and Control of Noise Levels and Codes of Practice

103 That each mining operation maintain noise maps based on full-scale conditions of operation which delineate all areas of work at which the noise level is 85 dB(A) or higher (p. 229

Re: Recommendation 103

Noise maps are not a practical solution. In surface plants, whole sections of buildings are designated as hearing protection areas and are posted as such, rather than post individual areas. Underground, certain types of work are designated as requiring hearing protection for everyone in the vicinity, since areas are continuously changing.

106 That the Occupational Health and Safety Authority issue a code of practice for the selection and use of personal hearing protection and for communicating in the presence of noise (p. 231)

Re: Recommendation 106

This has been addressed as CSA Standard #Z94.2 - M1984.

107 That, by statute, each mining company be made responsible for maintaining effective audiometric records for each employee who in the absence of hearing protection regularly encounters noise at levels of 85 dB(A) or higher, and that such audiometric records be required to be keyed 1/ to social insurance numbers, 2/ to Miner's Certificate numbers where such have been assigned and 3/ to a code number of noise-profile-encounter as previously recommended (p. 232)

Re: Recommendation 107

The Designated Substance Regulation for noise is about to be legislated. In the meantime, most mining companies maintain effective audiometric records for each employee in order to control costs of worker's compensation. The level of 85 dB(A) has been legislated through the adoption of the ACGIH values for TLV's (O. Reg. 654/86, Section 279)

109 That the Occupational Health and Safety Branch regularly inspect all audiometric testing facilities not under the supervision of a designated medical specialist, and that any designated medical specialist be required to certify biennially in writing that the facilities under his supervision conform to the minimum standards of the Branch as then current (p. 233)

Re: Recommendation 109

The Ministry carries out these duties under the supervision of medical specialists.

RECOMMENDATION

COMMENTS

Group F - Rehabilitation and Compensation Programs

F.1 Silicosis and Dust: Work Adjustment and Income Maintenance

21 That the current employees in the Elliot Lake uranium mines who are silicotics or exhibit dust effects (radiographic 4) in their lungs be eligible for a voluntary programme of work adjustment; that this programme be supported by management and unions; and that the Worker's Compensation Board provide rehabilitative compensation and supportive counselling services to assist the persons involved (p. 57)

Re: Recommendation 21

An assistance program supported by Management and Labour is already in effect for uranium mines in Elliot Lake.

22 That Section 53 of the Worker's Compensation Act be amended as necessary to provide clear entitlement for rehabilitative compensation based on the principle of work adjustment for persons subject to exceptional exposure to environmental hazards at work (p. 57)

Re: Recommendation 22

The programme is already in effect. The provisions of Section 53 of the WCB Act will be clarified when the Act is next reviewed. The December 1979 changes in the Act pertained to the amounts of various benefits payable.

24 That during a programme of personal rehabilitation through work adjustment, and for a minimum period of two years thereafter, the income of the worker be maintained in accordance with the provisions of the Worker's Compensation Act for full compensation which allow the Board to pay in non-taxable compensation 75 per cent of the difference between the current rate of pay and the rate of pay applicable at the date of entry into the programme (p. 58)

Re: Recommendation 24

Under the WCB's program, benefits are not limited to two years, but are payable throughout the period of wage loss.

RECOMMENDATION	COMMENTS
25 That in addition to wage maintenance, the worker in a work adjustment programme be eligible for rehabilitation training allowances as provided for in the Worker's Compensation Act (p. 58)	Re: Recommendation 25 The recommended provisions are already in effect and included in the existing programme. The Mining Health and Safety Branch is supporting and cooperating where appropriate. The Branch audits records and assists the WCB in investigating the claims. The Mining Health and Safety Branch provides the WCB with any available exposure record data for the individual.

RECOMMENDATION

F.2 Silicosis and Dust: Eligibility for Counselling Costs and Work Adjustment

26 That, further, the worker be entitled to reasonable costs for medical and personal counselling beyond that provided by the Workmen's Compensation Board, and to reasonable moving, travelling, and related relocation costs when these are applicable (p. 58)

27 That when the lungs of a worker exhibit dust effects and the worker seeks the opportunity through work adjustment to take employment with a new employer, the new employer not be held liable for any disability pension or other costs for silicosis or disease conditions related thereto that may be levied as a consequence of the person becoming a silicotic at a future date (p. 59)

29 That persons on the Uranium Nominal Roll who exhibit dust effects (radiographic 4) within twenty years of entry into Ontario dust exposure, and who have been employed in dust exposure in the uranium mines for a cumulative interval of five or more years from 1954 to 1975 inclusive, be eligible for rehabilitation assistance under a programme of work adjustment (p. 60)

Re: Recommendations 26 and 27

The recommended provisions are already in effect, and are included in the existing programme.

Re: Recommendation 29

The present assistance program was designed to encourage currently affected miners to leave exposure employment. Those who have already left the mining industry for other employment have made their adjustment, and the assistance program would not be necessary.

Should silicosis subsequently be diagnosed in a miner who has left the industry, this would be reported to the Board, and entitlement to the full range of benefits considered. The existing program is broader than the recommendation.

RECOMMENDATION	COMMENTS
30 That where there is evidence that the exposure of any person to silica-laden dust has been substantially in excess of established dust guidelines or standards and the person has exhibited dust effects in his or her lungs within twenty years of first exposure to dust in Ontario, the person be eligible for work adjustment rehabilitation assistance (p. 60)	Re: Recommendation 30 This is provided in the program already in effect. The Mining Health and Safety Branch assists the WCB in investigating the claimant's work and exposure history.

RECOMMENDATION	COMMENTS
F.3 Lung Cancer and Ionizing Radiation: Identification of and Compensation to Families of Deceased Workers	
53 That the Workmen's Compensation Board of Ontario, in collaboration with other provincial boards as provided for in interprovincial agreements, seek out and advise the families of all ascertained deaths due to lung cancer on the Nominal Roll that a claim for compensation should be entered (p. 109)	Re: Recommendation 53 This has been done by the WCB.

RECOMMENDATION

F.4 Accidents and Injuries: Reporting of Injury Statistics

54 That the Workmen's Compensation Board require and make provision for the inclusion in non-fatal injuries in which the injured person fails to return to his or her regular job on the day following the date of the accident giving rise to the injury (p. 121)

COMMENTS

Re: Recommendation 54

The recommendation refers to non-uniform standards in the recording of injury statistics in the mining industry due to some light duty injuries which are not reported to the Board.

Section 117 of the Worker's Compensation Act stipulates that employers have to notify the Board in writing of all accidents which disable the employee from earning full wages or that necessitate medical aid.

The existing provisions of the Act do not require an employer to report to the Board "first aid only" injuries, and therefore the statistics for such injuries cannot be compiled by the Board.

Although it is conceivable that in some "first aid only" injury cases, the worker might be temporarily assigned to other than his regular work, the number of such cases is considered to be relatively insignificant, because as soon as either medical aid or compensation for lost time beyond the day of accident are involved, the accident would have to be reported to the Board and would enter the Board's statistics.

A requirement that "first aid only" injuries be reported to the Board would necessitate an amendment to the Act, and, considering the additional administrative work involved to comply with such a requirement, the Board is not in favour of recommending such an amendment.

RECOMMENDATION

F.5 Toxic and Hazardous Substances: Eligibility for Compensation of Workers Exposed to Sulphur Dioxide

99 That workers in reduction plants who have been exposed for twenty years or longer to sulphur dioxide at levels approaching the current Threshold Limit Value and to associated dust and fumes, and who exhibit the clinical diagnosis of chronic bronchitis and impaired pulmonary function as identified by objective tests, be considered for compensation at up to a maximum of 20 percent disability (p. 219)

COMMENTS

Re: Recommendation 99

Subsequent to the 1978 mid-year Status Report, the original Ministry of Health studies were further analyzed in conjunction with a very limited amount of new data appearing in the world medical literature on the subject of Chronic Obstructive Lung Disease (C.O.L.D.) in persons exposed to nickel aerosols.

As a result of these further studies, the data were documented and guidelines for the adjudication of claims for Chronic Obstructive Lung Disease in Smelter workers relating to sulphur dioxide and particulate exposure were developed, presented and approved by the Board on September 19, 1979. The Board is now in a position to accept those claims where the criteria are met. Due to the multi-casual nature of this disease, partial liability has been determined at levels between 20% and 40% which is more generous than the original recommendation of 20% made by the Commission in its report.

A copy of the guidelines in question is attached as Exhibit 1.

RECOMMENDATION	COMMENTS
GROUP G. INSTITUTIONAL AND ORGANIZATIONAL INITIATIVES	
G.1 Training and Qualification: Qualification of Professionals and Accreditation of Workers	
71 That the core of the staff of the Mines Inspection branch continue to be based on persons of exceptional professional experience in mining, and related fields of engineering, supplemented by special training in occupational health and safety and in the principles of the administration of work (p. 163)	Re: Recommendation 71 The staff of the Mining Health and Safety Branch continues to consist of persons with excellent professional experience in mining. The Mining Health and Safety Branch sends its inspectors on courses relating to both administration and occupational health and safety.
73 That the industry, government, and labour give high priority to the development, standardization and accreditation of modular training and qualification for workers in mines and plants (p. 169)	Re: Recommendation 73 Modular training is required by Section 10 of the Ontario Regulation 569/83. The Ministry of Skills Development has established an extensive modular-training program for miners in most of the mining companies at this time. Accreditation is given for the basic training and certification for the 38 specialty skills. In addition, there is a program for first-line production supervisors in underground hard rock mines.

RECOMMENDATION

6.2 Research and Training in Occupational Health: University Programs of Research and Teaching of Professionals

88 That engineering schools review and redefine their responsibility to the profession to ensure that graduates are more keenly aware of an responsive to the impact of technological design upon the occupational health and safety of workers (p. 205)

COMMENTS

Re: Recommendation 88

Provincial Lottery funds have been provided through the Ministry of Labour to fund the development of four Occupational Health and Safety Resource Centres in the Province. One of their responsibilities is to encourage and assist engineering schools to provide their students with relevant OH&S knowledge. The Resource Centres are located at Queen's, Western, Waterloo and Lakehead Universities.

The Ministry of Northern Development and Mines commissioned a study, chaired by Mr. C.B. Ross, to examine the future needs of mining schools in Ontario. The report of this study was completed in 1987. A National Forum on Rock Mechanics Education is scheduled for May 1988, as a result of a recommendation of the Provincial Inquiry into Ground Control and Emergency Preparedness in Ontario Mines.

RECOMMENDATION

89 That resources for joint research and teaching by specialists in occupational health and safety in faculties of medicine and engineering be given high priority by both the universities and government (p. 205)

COMMENTS

Re: Recommendation 89

Through the Provincial Lottery, the Ministry of Labour has funded joint program development in occupational health and safety at McMaster University and the University of Toronto. Besides cooperation between the two universities, this program also involves collaboration between the Faculties of Preventative Medicine and Engineering at U of T. The bulk of the program is post-graduate leading to degrees or diplomas such as M.Eng., D.I.H., M.H.Sc. Occupational Health and Safety material is also part of under-graduate courses. Subsequent to the Provincial Inquiry into Ground Control & Emergency Preparedness in Ontario Mines, the Province has established two chairs in mining research at Queen's University and Laurentian University.

The Ministry of Labour is part of joint research programs with the Canadian and US governments involved in Diesel Emission studies and Ground Control. Direct funding of a study into the development of improved respirators has been provided to Laurentian University. Cooperative research with the Federal government and the mining industry has been undertaken for Rockburst Research ($4.2 million) and into Backfill Technology and Mine Design ($3.5 million) through a Canada-Ontario Mineral Development Agreement.

Further to another recommendation of the Stevenson Inquiry, a Mining Research Directorate has been established in Sudbury, under a tripartite Board of Governors to undertake cooperative mining research programs.

RECOMMENDATION	COMMENTS
8.3 WCB Agreement and Levies: Funding of Worker-Auditors and Joint Health and Safety Committees' Research Programs	
62 That the Workmen's Compensation Act be amended to make provision for the assessment of the costs of worker-auditors upon employers in class 5 (p. 154)	Re: Recommendation 62 The selection of a worker-auditor is provided for in Section 8(8) of the Act. (See discussion of Recommendations 60 to 65. Group 8.3). Section 8(12) of the Act stipulates that the worker selected as a member of the joint committee must be paid at his regular or premium rate as appropriate. To date there has been no indication from the companies that there is a need for funding to cover the costs of such workers on a collective basis, through the WCB, or otherwise.
113 That under the Workmen's Compensation Act provision be made for the levying on all employers in class 5 an amount of 0.03 per cent of wages currently subject to levy under the Act to create a fund for research on occupational health and safety by the joint labour-management health and safety committees (p. 239)	Re: Recommendation 113 This recommendation has not been implemented because funds for research projects have been made available from lottery funds, Ministry of Labour funds and WCB funds.

RECOMMENDATION

G.4 Medical Programs: Industry-Level Medical Consultation Services

111 That the mining industry establish for its employees, where such is not now provided, occupational health surveillance by a supervising medical director or consultant experienced in occupational medicine (p. 237)

112 That the labour unions individually or in consort appoint to their staff a consulting specialist in occupational medicine (p. 237)

COMMENTS

Re: Recommendation 111

Medical surveillance is an integral component of the Designated Substance REgulations. Most employers, accordingly, have physicians responsible for medical surveillance. In addition the Ministry's physicians are available to assist employers set up a medical surveillance program and advise their colleagues on occupational medicine.

Unions have access to and use specialists in occupational medicine to advise them as well as carry out independent studies.

STATUS OF THE RECOMMENDATIONS OF THE ROYAL COMMISSION
ON THE HEALTH AND SAFETY OF WORKERS IN MINES (HAM COMMISSION)
as of January 1988

INTRODUCTION

To discuss the implementation of the recommendations made by Dr. Ham, the recommendations have been categorized into 7 groups.

GROUP	SUBJECT	RECOMMENDATIONS
A	POLICY FOR OCCUPATIONAL HEALTH AND SAFETY	114, 115, 116 & 117
B	POLICY GUIDELINES FOR THE INTERNAL RESPONSIBILITY SYSTEM	
	.1 Role of Management & Labour	7, 72
	.2 Accidents & Injuries	55, 59, 70
	.3 Worker Auditors	60, 61, 63, 64, 65
	.4 Joint Health & Safety Committees	66, 67, 68, 69 & 55
	.5 Refusal to Work in Unsafe Conditions	79, 80 & 81
C	STUDIES & RESEARCH	
	.1 Silicosis & Dust	1, 2, 3, 28
	.2 Studies of Environmental Conditions	17, 18, 6
	.3 Lung Cancer & Ionizing Radiation	31, 37, 39
	.4 Epidemiological Studies	33, 43, 44, 45, 52
	.5 Injury Risk Factors	57, 58, 78
	.6 Toxic Substances	90, 93, 94
	.7 Noise	104, 108

GROUP	SUBJECT	RECOMMENDATIONS
D	**STANDARDS, GUIDELINES & CODES OF PRACTICE**	
	.1 Silicosis & Dust	11,12,13,14,15,16
	.2 Lung Cancer & Ionizing Radiation	34, 35, 36, 37
	.3 Lung Cancer & Ionizing Radiation	38, 40, 41, 42
	.4 Noise & Toxic Substances	110
E	**WORKPLACE PROGRAMS**	
	.1 Silicosis and Dust	4, 5, 19, 20
	.2 Silicosis and Dust	8, 9, 10
	.3 Lung Cancer & Ionizing Radiation	32, 39, 46, 47, 48
	.4 Job Rotation & Record Maintenance	23, 49, 50, 51
	.5 Accidents & Injuries	56
	.6 Working Alone	74, 75, 76, 77
	.7 Toxic & Hazardous Substances	83, 83, 84
	.8 Toxic & Hazardous Substances	85, 86, 87
	.9 Recording Hazardous Substances	91, 92
	.10 Diesel Emissions	100, 101, 102
	.11 Noise	103, 106, 107, 109

GROUP	SUBJECT	RECOMMENDATIONS
F	REHABILITATION AND COMPENSATION PROGRAMS	
	.1 Silicosis & Dust	21, 22, 24, 25
	.2 Silicosis & Dust	26, 27, 29, 30
	.3 Lung Cancer & Ionizing Radiation	53
	.4 Accidents & Injuries	54
	.5 Toxic & Hazardous Substances	99
G	INSTITUTIONAL AND ORGANIZATIONAL INITIATIVES	
	.1 Training & Qualification	71, 73
	.2 University Programs	88, 89
	.3 Funding by WCB	62, 113
	.4 Medical Programs	111, 112

Mining Health
and Safety Branch
Ministry of Labour

Safety in Ontario Mines

Appendix C
Recommendations of the Burkett Commission

STATUS OF THE RECOMMENDATIONS OF THE JOINT FEDERAL-PROVINCIAL INQUIRY COMMISSION INTO SAFETY IN MINES AND MINING PLANTS IN ONTARIO - (THE BURKETT REPORT, APRIL 1981) January 1988

RECOMMENDATION	COMMENTS
CHIEF EXECUTIVE OFFICER	
1. That the chief executive officer of each mining company operating in Ontario review his personal commitment and contribution to the safety performance of his organization with a view to exercising his authority and leadership in the manner outlined.	Re: Recommendation 1 There is no doubt that the personal commitment of the CEO of a company is essential to the performance of safety in that company. Most companies have a written safety policy and performance objectives to ensure that supervisory staff will aim to achieve those objectives.
2. That where the Mining Health and Safety Branch identifies an operation as sub-standard, the district engineer meet with the manager of the operation to review performance and to advise of the branch's response; and further, that the branch so notify the chief executive officer by registered letter.	Re: Recommendations 2 and 3 Where an operation is judged sub-standard, Branch Inspectors meet with the Mine Manager and corrective action is taken. Where the corrective action has called for an extensive programme which needs to be scheduled, over a period of time, the meeting takes place with management and the health and safety committee. This type of meeting has been convened by the inspectors and a staff engineer, or the Director, depending on the severity of the situation. In some cases, it has been necessary to involve the Chief Executive Officer.
3. That where the Mining Health and Safety Branch identifies a company as having sub-standard performance, the Director of the Mining Health and Safety Branch meet with the chief executive officer of the company to review performance and to advise of the Branch's response.	

RECOMMENDATION	COMMENTS
4. That the Mining Health and Safety Branch review the cost indicator models being developed by the United States Bureau of Mines for metal mines and assess their applicability to Ontario mining operations. Using these cost indicator models or some modification thereof, the costs of accidents to each mining company (by operation) be computed on an annual basis.	Re: Recommendations 4 and 5 It would appear that the cost indicator models being prepared by the U.S. Bureau of Mines have been postponed due to constraints. The Branch feels that we should prepare our own cost indicator models especially for the serious and severe accidents that have occurred recently. A more sophisticated information system has to be organized (WCB style) to collect and analyze the data.
5. That a company operating a mine or mining plant in Ontario include in its annual report a comprehensive statement of safety performance including relevant comparative data and a statement of costs incurred.	
6. That a workmen's compensation merit rating scheme, tailored specifically to the mining industry, be introduced.	Re: Recommendation 6 The MAPAO publishes injury statistics on all mining companies on a monthly basis, with each company's frequency for lost time and medical aid injuries. These statistics are available for everyone in the industry and are, in effect, a merit rating scheme.
7. That the Mines Accident Prevention Association of Ontario carry out independent safety audits and that each mining company operating in Ontario consent to having the MAPAO perform an annual safety audit.	Re: Recommendation 7 The MAPAO have been carrying out safety audits under the International Safety Rating System (ISRS) at most companies in the province. These have been high successful in some of the larger companies with dramatic reduction in lost time injuries. The audits are less applicable to smaller, less sophisticated operations, and have had to be modified accordingly.

RECOMMENDATION

8. That the individual companies be ranked on the basis of the audit results and that the ranking be made public by the MAPAO.

COMMENTS

Re: Recommendation 8

To be effective, the ISRS needs to be fully accepted by the company, and companies are not willing to accept being ranked on the basis of audit results. Since it is only one tool among several which can be used to improve safety, this recommendation has not been enacted. However, the audit results are generally shared with the joint health and safety committee and planning for improvement should be a joint exercise.

RECOMMENDATION	COMMENTS
FIRST LINE SUPERVISORS	
9. That a committee be struck, with representative of the mining companies, the unions representing workers in mines and mining plants and the government for the purpose of developing a modular training program for first line supervisors in both underground and surface operations and that individuals be certified by the company conducting the program as competent to supervise in a mine or mining plant upon successful completion.	Re: Recommendation 9 A modular training program for first line production supervisors has been developed jointly by labour and management and the Ministry of Skills Development and was enacted into legislation in June 1987 by an amendment to Section 10 of Ontario Regulation 694.
10. That from the date the program commences only persons who have such certification be appointed to fill regular first-line supervisory positions. 11. That persons occupying first-line supervisory positions as of the date the program commences, be required to complete the program and become certified within a reasonable time period stipulated by the tripartite committee.	Re: Recommendation 10 and 11 Section 10(2) of Ontario Regulation 694 requires that an underground worker who commences employment after June 1987, is required to be trained in the Basic Common Core Program, during the first year of employment. Likewise, a newly appointed underground production supervisor will be expected to be trained in the Common Core for First Line Production Supervisors, in order to qualify as a competent person, as required in Section 14 of the Act.

RECOMMENDATION

12. That the number of first-line underground supervisors employed by each mining company be sufficient to allow for at least two workplace contacts with each crew per shift and that the time alloted for these visits be sufficient to allow for adequate assistance and instruction to inexperienced crews and crews working in difficult areas.

13. That wherever practical, a minimum of two group leaders for each first line underground supervisor be appointed.

14. That individual work crews be more involved in the planning of their work and, in conjunction with group leaders, be made responsible for achieving short-term production targets.

15. That first-line supervisors assume an enlarged role as facilitatory, resource persons and safety auditors.

COMMENTS

Re: Recommendation 12

Traditionally, the number of first line underground supervisors is designed to allow for two visitr to each workplace on each shift, allowing sufficient time for individual contacts including assistance and instructions. However, some companies are changing the traditional concepts, as described in 15 below.

Re: Recommendation 13

The appointment of stope bosses and drift leaders have been standard practice in mines for many years. Also see 14 and 15 below.

Re: Recommendation 14

It is agreed that individual work crews should be involved in the planning of their work. Some mines are experimenting with the team concept, where first line supervisors are replaced by team leaders.

Re: Recommendation 15

In mines where the team concept is being used, the first line supervisors become co-ordinators or facilitators, who are responsible to plan the work, co-ordinate movement of supplies and equipment and to look after training. In other mines the role of the supervisor is mostly that of a resource person, planner and safety auditor, and to ensure that workers have significant involvement in the planning of their work.

RECOMMENDATION

16. That the ministry adopt an even-handed and consistent practice with respect to prosecutions and make known to the industry that it will not seek to prosecute a first-line supervisor or any other employee unless satisfied that he or she has failed to take every precaution reasonable in the circumstances of has otherwise clearly acted negligently in complying with the Act and regulations.

COMMENTS

Re: Recommendation 16

The Mining Branch observes the criteria set out in the Ministry of Labour prosecutions policy. No person will be prosecuted unless he or she had failed to take every precaution reasonable in the circumstances or has otherwise clearly acted negligently in complying with the Act and regulations.

RECOMMENDATION	COMMENTS
THE WORKER	**Re: Recommendation 17**
17. That each worker review his commitment to safe work practices and undertake to work in a safe manner at all times and to assume the full range of his responsibilities as a member of the direct internal responsibility system.	It is management's responsibility to ensure that the worker understands his responsibilities as a member of the direct internal responsibility system. Each worker should then be prepared to review his commitment to safety and undertake to work in a safe manner at all times.

RECOMMENDATION

JOINT HEALTH AND SAFETY COMMITTEE

18. That provision be made in law for a full-time worker safety representative in each mine or mining plant employing more than 500 workers, and that where the number of workers in any mine or mining plant is less than 500, provisions be made for the appointment of a worker safety representative to spend a proportionate amount of work time engaged in safety related activities.

19. That a worker safety representative hold office for a two-year term and work closely with the company's safety department.

20. That a worker safety representative be a member of the joint health and safety committee otherwise qualified to serve in this position.

21. That a worker safety representative not be permitted to hold any union office or to engage in partisan union political activity of any kind.

22. That a worker safety representative be paid the full amount he would have been paid had he continued in his classification.

23. That a worker safety representative report all workplace anomalies to first-line supervision and to the safety department and that only in the event that the condition is not corrected to the satisfaction of the worker safety representative within a reasonable period of time should the matter be taken up with the joint health and safety committee.

COMMENTS

Re: Recommendations 18 to 24 inclusive

There has been considerable discussion on the subject of full-time worker safety representatives by the Mining Legislative Review Committee. All are agreed on the principle of worker involvement but there are differences in opinion on how to achieve this, and on their responsibilities and affiliations. Worker safety representatives are in place at most of the larger mining companies, having been negotiated through the respective collective bargaining agreements. They seem to be working out quite well.

Of the mines employing more than 500 workers, the majority have worker safety representatives.

RECOMMENDATION

24. That the existing provisions of the Act which allows the minister to grant exemptions also apply to the election or appointment of worker safety representatives.

25. That membership on joint health and safety committees be restricted to workers not holding other union positions and to line supervisors or managers, and that workers acting as committee members not be permitted to engage in partisan union political activities.

26. That joint training for members of joint health and safety committees be undertaken and, where possible, supervisors also be involved.

27. That, in the absence of agreement to the contrary, the costs of such programs be charged back to the company or union on per participant basis.

28. That the allocation of government monies to health and safety training be on condition that joint training be carried out wherever possible.

COMMENTS

Re: Recommendation 25

The unions strongly reject the recommendation that membership on joint health and safety committees be restricted to workers not holding other union positions. Although in theory the recommendation appears to have merit, there are good practical reasons why it cannot be applied, such as the availability of workers willing to fill the positions.

Re: Recommendation 26

It is generally agreed that joint training should be carried out on a continuous basis with supervisors totally involved. This occurs with worker and supervisor trainees taking the common core programme together in some mines.

Re: Recommendation 27

The costs of such programmes have always been assumed by the company employing the students.

Re: Recommendation 28

The only government monies which are allocated to health and safety training are provided by the WCB to the Safety Associations and to the Ontario Workers Occupational Health and Safety Health Centre. The Safety Associations provide various services to the industry, including training programs, some of which are joint training and others which are specifically for management or workers. Likewise, the OWOSH Centre provides training, mostly to workers but on request also to supervisors.

RECOMMENDATION

29. That the chief executive officer and management of each mining company ensure that the joint health and safety committee is consulted on the full range of safety issues and that the documentation, data, materials and other information necessary for this purpose be made available to it.

30. That the joint health and safety committee monitor the use of discipline as a tool in the achievement of safety recommendations.

31. That at least one of the worker members of the joint health and safety committee (preferably the full time worker representative) be given sufficient time to prepare the worker portion of the committee agendas and to investigate and inquire into the matters which are before the committee.

32. That the worker members of the joint health and safety committee be provided with a private office (which may also double as the worker safety representative's office) equipped with adequate furniture and supplies and that typing and reproduction services be made available by the company.

COMMENTS

Re: Recommendation 29

The joint health and safety committee provides a forum for communication and resolving work place concerns in a cooperative fashion. The Ministry inspectors check that the committees are functioning properly and are provided with means to do so.

Re: Recommendation 30

In discussing this recommendation, the Burkett report assumes it to be concomitant with Recommendation #25, which has proven to be impractical. However, there is no reason why this should inhibit the committee from making recommendations as to the use of discipline both generally and in individual cases.

Re: Recommendation 31

Both the companies and the unions agree that one worker member of the health and safety committee be given sufficient time to prepare the worker portion of the committee agenda.

Re: Recommendation 32

It should be possible in the case of large operations to provide an office for worker safety representative or the health and safety committee members, however it could be difficult in smaller operations and may not be necessary.

RECOMMENDATION	COMMENTS
THE SAFETY DEPARTMENT	Re: Recommendations 33 and 34
33. That in addition to assisting the line organization, the safety department within each company be made responsible for auditing the safety performance of the line organization.	In most companies the Safety Department is responsible for auditing the safety performance of the line organization and has direct reporting access to the Mine Manager. The reporting relationship should be direct to the person in charge of the total operation.
34. That the manager of the safety department have direct reporting access to senior executives responsible for the line organization including the chief executive officer.	
35. That first-line supervisor receive the requisite training and carry out workplace safety inspections as part of a planned program of rotation of first-line supervisors through the safety department.	Re: Recommendation 35 Many companies endeavour to rotate first-line supervisors through the Safety Department to improve their knowledge and contribution to the safety programme.
36. That each local union representing workers in Ontario mines and mining plants review its approach to health and safety matters and take the steps necessary to commit itself to a course of union-management cooperation in health and safety administration.	Re: Recommendation 36 The unions feel that each local has committed itself to a course of union/management cooperation and continues to do so.
37. That each parent labour body actively encourage and support union-management cooperation in health and safety matters at the local level and cooperate with the industry in those health and safety endeavours which require the direct involvement of the parent body.	Re: Recommendation 37 The unions feel that the parent body has actively encouraged and supported union/management cooperation. They feel that the recommendations should be changed to read that each labour body continue to actively encourage, etc.

RECOMMENDATION

MINES ACCIDENT PREVENTION ASSOCIATION OF ONTARIO

38. That the Mines Accident Prevention Association of Ontario sever its ties with the Ontario Mining Association, retain the services of a full-time executive director, establish its own offices, make provision for its own support staff and services, and continue to be financed by levies against its member companies.

39. That the Mines Accident Prevention Association of Ontario establish labour-management advisory committees at both the provincial and regional levels and that it move to include representatives of labour and the public on its board of directors.

COMMENTS

Re: Recommendation 38

This has been done.

Re: Recommendation 39

The Mines Accident Prevention Association has made some efforts to have some labour participation in its technical standing committees and on its Board of Directors. However, the unions were never satisfied with the limitations stipulated by the MAPAO, and following a misunderstanding, withdrew their representatives. The MAPAO maintain that they are still seeking labour participation. In the meantime, the Educational Health and Safety Education Authority of the WCB, has funded the Ontario Workers Occupational Safety and Health Centre in Toronto, together with five branch offices. The purpose of this organization is to provide training to workers, particularly in health and safety. Amongst others they train members of Health and Safety Committees to recognize hazards in the work place, and they train workers to be trainers of their peers. They have been invited by at least one major company to train supervisors at the same time.

RECOMMENDATION	COMMENTS
MINING HEALTH AND SAFETY BRANCH	
40. That the Mining Health and Safety Branch advise the industry and its workers in writing of its policies and practices with respect to the enforcement of the Act and regulations and apprise the industry and its workers of any changes to its policies and practices or the adoption of any new enforcement initiatives.	Re: Recommendation 40 The Mining Health and Safety Branch advises industry and workers of its policies and practices by meeting with various groups and discussing enforcement. It also distributes information in writing to targeted groups. In addition there is the tripartite program consisting of 39 audio visual modules describing the performance objectives of the Act and regulations, which was prepared jointly by the Branch, industry and labour, and which is available to all.
41. That the branch inspector meet with a worker representative and employe representative before commencing a workplace inspection and that these representatives be required to identify, in the manner described, all unresolved health and safety concerns. 42. That the branch inspector meet with these worker and employer representatives after the workplace inspection to review their previously identified concerns in light of the results of the inspection. 43. That the branch inspector review, in the presence of the representatives, the minutes of the health and safety committee meetings which have occurred since the previous inspection.	Re: Recommendations 41, 42 and 43 Copies of health and safety committee minutes have been sent to the Mining Branch offices for many years. The Branch inspectors discuss any concerns that the worker representative may have, prior to the commencement of the inspection. In some cases these concerns become the focus of the inspection.
44. That following <u>each</u> inspection, the branch inspector be required to file with his supervisor a written report on the performance of the internal responsibility systems at the particular operation.	Re: Recommendation 44 Branch inspectors discuss problems with the Internal Responsibility System with their supervisors following inspections at these operations. Various reports such as assessment reports, orders, accident reports, Joint Health and Safety Committee minutes, etc., form the basis for auditing IRS.

RECOMMENDATION

45. That branch inspectors be given the training necessary to carry out these responsibilities.

46. That the Mining Health and Safety Branch develop the capability of responding to relationship difficulties that are impeding health and safety performance.

47. That the future recruitment of branch inspectors be based in part upon interpersonal skills and that, in addition to their present duties, inspectors be assigned on-site monitoring of the direct and contributive responsibility systems at the workplace.

48. That, wherever possible, branch engineers be relieved of workplace inspection and be assigned responsibility for investigation, predevelopment review, consultation, educational activity and response to responsibility system breakdowns.

49. That the future recruitment of branch engineers be based in part upon interpersonal skills and the potential to act in a mediative mode, and that the training and development of branch engineers include these aspects.

COMMENTS

Re: Recommendation 45

Branch inspectors are involved in the development and delivery of all MHSB training programs. A curriculum has been established for inspectors, including training in interpersonal skills, IRS, the regulations, policies and procedures.
A training module on IRS is being designed with labour and industry input.

Re: Recommendation 46

In addition to improving Branch staff capabilities skills, the Ministry has established an Advisory Service to provide additional resources where IRS is faltering due to relationship differences.

Re: Recommendation 47, 48 and 49

Engineers have been relieved of workplace inspections and have been assigned the responsibility for investigation, predevelopment review, consultation, educational activity, and response to responsibility system break-downs as recommended. It is working well. Engineers support the inspectors in investigations. The recruitment of branch engineers and/or inspectors is based on their background knowledge and upon interpersonal skills.

RECOMMENDATION	COMMENTS
50. That the tripartite committee responsible for reviewing the mining regulations study all recommendations made by coroners' juries investigating mining fatalities for possible general application and make appropriate recommendations.	Re: Recommendation 50 The Mining Health & Safety Legislative Review Committee continues to study all recommendations made by each Coroner's Jury. This has been branch practice since 1977.

RECOMMENDATION

GROUND CONTROL AND LIGHTING

51. That wherever practical, fall-on protection be installed on all man-operated equipment.

52. That each mining company operating in Ontario employ at least one professional engineer with post-graduate qualification in rock mechanics and that a person holding such qualification be used in the design and planning of a mine or mine expansion and that a person holding such qualification be used in the design and planning of a mine or mine expansion and that a person holding such qualification be made responsible for the company's ground control program.

53. That a committee of the Mines Accident Prevention Association of Ontario be struck to design a course of study in ground control to be offered through appropriate community colleges of Applied Arts and Technology.

54. That a planned and systematic program of visual inspection of each active work area be conducted in each mine.

55. That the inspections be carried out by persons who have specialized knowledge in rock mechanics.

56. That these inspections be carried out under an auxiliary source of high intensity lighting.

COMMENTS

Re: Recommendations 51 through 61

A Tripartite Committee was formed in 1984 to review the implementation of recommendations in the Burkett report. As a result, and because of a high number of groundfall fatalities that year, it was decided that a focussed inquiry into ground control and emergency preparedness was warranted. This led to the formation of the Provincial Inquiry into Ground Control and Emergency Preparedness in Ontario Mines.

As a result of this inquiry, five new regulations were added under the Occupational Health and Safety Act. Section 5a. requires the preparation of a mine design by a qualified person for each mine, and which must be updated at least annually. Section 10 makes changes in the common core program and includes expanded modules on ground control. Section 62a. requires that a written procedure for communication of ground conditions between workers and supervisors be established at each mine. Section 65a. establishes a minimum cap lamp standard, based on a study conducted by Branch specialists. This section further requires the use of auxiliary lighting where the cap lamp is inadequate. Section 66a. requires fall-on protection for mobile vehicles in certain instances.

These and other initiatives into ground control aspects are more fully explained in the response to the Provincial Inquiry into Ground Control and Emergency Preparedness in Ontario Mines.

RECOMMENDATION	COMMENTS
57. That the person making these inspections be required to file regular written reports with the supervisor of the inspection program.	
58. That work crews be formally and systematically made aware of ground conditions in the areas in which they are working.	
59. That inadequate lighting be investigated as a possible cause of all reportable underground accidents and that in all cases of serious underground accidents, photometric values be recorded by persons trained in the use of photometric equipment.	Re: Recommendation 59 The Branch measures lighting levels in all fatal accidents where lighting may have been a factor.
60. That the Mines Accident Prevention Association of Ontario, in conjunction with the industry, undertake a comprehensive research program to satisfy the needs which have been identified.	Re: Recommendations 60 and 61 This research was carried out under the direction of an expert in mine lighting who was recruited by MAPAO.
61. That an independent authority in the field of mine lighting be retained to direct and co-ordinate the research effort.	

RECOMMENDATION	COMMENTS
WORKER TRAINING	
62. That, upon implementation of the modular training program in specialized skills for underground miners, a modular training program for surface operations be developed.	Re: Recommendation 62 On completion of the full modular training program for underground miners, including the specialty skills, the Ministry of Skills Development Committee directed its attention to "soft rock" mining for the gypsum and salt mines in Southern Ontario and to the supervisor's training program. There is a training program for mill workers nearing completion, one for diamond drilling operations has just been started.
63. That the Mines Accident Prevention Association of Ontario investigate and develop appropriate screening tests for prospective underground miners and make these available to the industry.	Re: Recommendation 63 Both the companies and unions have rejected the recommendation for the development of appropriate screening tests for prospective underground miners. It was considered that this function is better carried out by the mandatory requirement for common core training for new underground miners and by the re-training programs in the various company organizations.
64. That the common core modular training program be augmented by a formal program of on-the-job training leading to full production capability.	Re: Recommendation 64 Each modular training and common core program has been augmented by supervised on-the-job training leading to full production capability. Formal training is also given in the specialty skills including performance demonstrations which must be passed successfully before accreditation is given, leading to ultimate certification as a miner.
65. That each mining company undertake a comprehensive audit of the skills of its underground miners with a view to using modular training to upgrade skill levels.	Re: Recommendation 65 Due to cutbacks over the past few years, the mining companies have had to undertake a comprehensive audit of the skills of their underground miners and to provide the requisite modular training to upgrade these skills. This has come about because of workforce reduction and the need to retrain older workers so that they may be posted into the available jobs.

RECOMMENDATION

ALCOHOL AND DRUGS

66. That the Mines Accident Prevention Association of Ontario obtain the concurrence of the managements of three major mining operations and commission a study to determine the extent of the relationship between alcohol an drug use and accidents at each of these operations.

67. That the results of this study be compared with the results of a survey of the accident report forms submitted to the Workmen's Compensation Board by each of these operations; and that, if the results differ significantly, appropriate changes be made in the manner in which alcohol and drug use is identified and reported as a cause of accidents.

68. That the study include an analysis of the organizational arrangements and the systems of control and communication at each of these operations with a view to determining if these factors contribute to the degree of alcohol or drug use by workers within each operation.

69. That Ontario mining companies and the unions representing workers in the mining industry seriously consider adoption of an approach to the management of alcohol and drug abuse in the workplace along with the lines suggested.

COMMENTS

Re: Recommendations 66 to 69

The MAPAO together with the Addiction Research Foundation established an ad hoc committee from management and unions to investigate the problem of alcohol and drug abuse in the industry. A public seminar was held at Laurentian University in 1985. The larger mining companies have excellent alcohol and drug abuse programs. Most smaller companies have voluntary company/union programs in place, which are working well.

RECOMMENDATION

CONTRACTORS

70. That whenever a contractor is engaged, the company meet with the contractor before commencement of the project to stipulate the safety requirements which must be met if the contractor is to be permitted to commence or continue the project.

71. That the project be rigorously inspected by the company to ensure compliance with these requirements.

72. That a mining company give preference in the awarding of contracts to contractors who have demonstrated satisfactory safety performance; and that the company consider a reward-penalty contract provision related to safety performance on the project.

73. That the Mining Health and Safety Branch be advised by each mining company of all contract projects well in advance of the starting date of such projects.

74. That the Mining Health and Safety Branch increases its regular inspections of these projects and, using its accident profile data, devote special attention to those contractors who demonstrate unsatisfactory safety performance.

COMMENTS

Re: Recommendations 70 through 73

There is general agreement with the recommendations regarding contractors with the exception of Number 72 where the company is expected to consider a reward/penalty contract provision related to safety performance on the project. Companies state this would be extremely difficult to administer. They have taken a pro-active stance by screening the contractors and going over the job procedures. The unions suggest that they could have a positive role in safe work procedures by having the right to inspect the contractor's workplaces. This is a matter for local determination and would depend on whether the contractor had a safety committee unit or not. The company still has the obligation to ensure that the contractor complies with the OHS Act and Regulations.

Re: Recommendation 73 and 74

The Mining Health and Safety Branch is advised by the mining companies of all contract projects well in advance of the start-up date and as a result has been able to increase its regular inspections of these projects.

RECOMMENDATION	COMMENTS
75. That a system of merit rating for purposes of determining the amount of the Workmen's Compensation assessment for contractors operating in the mining industry be established; and that separate rate groups be established for shaft sinking and mining contractors, general contractors and diamond drilling contractors.	Re: Recommendation 75 This matter has to be answered by the WCB.
76. That the chief executive officer of each contractor engaged in projects for Ontario mines and mining plants review his personal commitment and contribution to the safety performance of his organization with a view to exercising his authority and leadership.	Re: Recommendation 76 The Chief Executive Officer should periodically review his/her personal commitment to safety and this commitment should be communicated in writing.

RECOMMENDATION

ACCIDENT DATA BASE

77. That the Ministry of a Labour, in consultation with management, labour, and the Mines Accident Prevention Association of Ontario, determine the specific information required to maintain an occupational accident data base for mines and mining plants which satisfies the prerequisites identified, and provide the Occupational Health and Safety Division of the Ministry with the resources and expertise necessary to collect this information, analyze and disseminate it.

COMMENTS

Re: Recommendation 77

Because of apprehension that the Ministry might wish to use information obtained from the gathering of accident statistics for prosecution purposes, the decision was made for the MAPAO to be the authority for the Accident Data Base. A tripartite committee was set up to design the system. This committee was highly successful in developing a form that is concise and is in use by all companies for their accident reporting system. It is interesting to note that Energy Mines and Resources Canada has adopted the MAPAO system for the collection of injury data for application Canada-wide. Also, British Columbia has modelled its accident data base on the MAPAO system.

RECOMMENDATION

JURISDICTIONAL AND ADMINISTRATIVE ARRANGEMENTS FOR SAFETY OF ONTARIO URANIUM MINERS

78. That the Government of Canada incorporate by reference, the Ontario Act and regulations, as amended from time to time, directly into the Canada Labour Code as a provision covering uranium miners and plant workers, and also provide in the code that, where the other provisions of the code and this provision are in conflict the latter shall apply.

79. That the Government of Canada proceed by way of a reference to the Supreme Court of Canada by the Governor General in Council under section 55 of the Supreme Court Act, R.S.C. 1979 C. S-19 and determine whether the federal jurisdiction is exclusive or concurrent.

80. That the Government of Canada and Ontario continue the arrangement under which the enforcement of statutory health and safety requirements in Ontario uranium mines is assigned to provincial authorities.

COMMENTS

Re: Recommendations 78 through 80

The jurisdictional arrangement for Uranium Mines was finalized by agreement on the 18th of June and by Order in Council on the 1st of July, 1984.

RECOMMENDATION

PRODUCTION BONUS

81. That individual mining companies and their respective unions agree to discontinue individual (or small crew) production incentive plans.

82. That the government make known its intention to legislate an end to direct individual (or small crew) production incentive plans in Ontario mines if these plans are not voluntarily discontinued.

COMMENTS

Re: Recommendations 81 and 82

There is a consensus which flows from the report prepared by Jim Fisher of Peter Moon and Associates, that there does not appear to be any great difference between bonus and non-bonus accidents.

A study by the University of Laval for the Quebec mining industry came to conflicting conclusions. They found that for development mining, safety improved slightly with bonus but that for production mining the converse was true.

In a meeting of the Mining Legislative Review Committee in September 1986, it was resolved that the MLRC does not agree to the elimination of the bonus incentives system.

A recent study on the subject shows that in the larger mines where bulk mining methods are the trend, individual bonus has given way to group bonus. In other words, group bonus is evolving as a result of modern mining technology.

Mining Health
and Safety Branch
Ministry of Labour

Safety in Ontario Mines

Appendix D
Recommendations of the Stevenson Inquiry

RECOMMENDATIONS OF THE PROVINCIAL INQUIRY INTO GROUND CONTROL AND EMERGENCY PREPAREDNESS IN ONTARIO MINES

RECOMMENDATION	COMMENTS
1. RESEARCH	
1.1 That mining companies be encouraged to continue conducting independent research programs as they see fit.	A research coordinating body, called the Mining Research Directorate, has been established and is presently located at Laurentian University in Sudbury. The MRD is financed through the Ontario Mining Association and is governed by a Board of Directors made up of representatives from industry, labour and government. The MRD has a technical advisory committee, comprised of engineers within the industry, with a goal of identifying needed research. Once an individual project has been approved, the MRD seeks funding from appropriate companies or government agencies and establishes a contract. Other programs have been established to generate geomechanics research in Ontario. A Rockburst Research project, presently in its third year of a five year program, is equally funded by the governments of Canada and Ontario and industry. This program, aimed specifically at a better understanding of the causes of rockbursts and the minimization of their hazard, is expected to cost in excess of $4.2 million. Another program established under a Canada-Ontario Mineral Development Agreement, is directing $3.5 million towards research into backfill in mines and mine design. This project is also in the third year of a five year program.
1.2 That mining companies, with the support of labour and government, shall establish a research organization to act as a central body to coordinate research into ground control and rock mechanics in Ontario mines. This coordinating body shall be managed by a Board of Directors made up of members currently active in the industry an representing all facets of it -- management, labour and government. The Board would appoint an Executive Director who, with an appropriate staff, would manage the research coordination and to be accountable to the Board. The initial program would cover at least the following areas: a) Identify ground control problems in Ontario mines; b) Identify needed research and the appropriate agencies to conduct it; c) Contract for the necessary research to be done, and supervise its quality;	

RECOMMENDATION	COMMENTS
Research 2.2 Continued	
d) Ensure that the results of the research are published on a regular basis so that mine management, appropriate labour representatives and government agencies are fully informed; and	
e) Participate in the development of guidelines for the implementation of safe ground control practices.	
3. This organization shall be funded by mining companies operating in Ontario, and by the federal and provincial governments.	
4. Among the subjects the organization shall consider for funding are the following:	
Rockbursts/Destressing/Backfill (including quality monitoring and backfill testing methods)/Blasting (including vibration damage and drilling controls)/ Ground support (including rockbolting and mechanical supports)/ Monitoring and testing of ground conditions/Mine lighting/Computer modelling/ Equipment design and mechanization as it applies to hazardous ground conditions.	

RECOMMENDATION	COMMENTS
2. TRAINING	
2.1 That a separate section on ground control be added to the skills included in the Common Core training for new underground miners.	The Common Core training for underground miners is required under Section 10 of the regulations under the Occupational Health and Safety Act. This regulation has been revised to expand the requirement for training to all new underground miners.
2.2 That the present tripartite committee established to approve modular training programs shall expand those programs to include specialist modules on ground control for all underground miners.	10. (1) Employers in the following types of mines and mining plants shall establish and maintain the following training programs developed jointly by labour and management in the mining industry and the Ministry of Skills Development and approved by the Director:
2.3 That all miners receive periodic refresher courses in ground control if required. Labour shall be encouraged to participate in the development of the curriculum.	1. Hard rock underground mines,
2.4 That miners who have been off the job for one year or more should be evaluated with respect to their knowledge of current ground control practices, an should receive appropriate training where necessary before they return to regular underground work.	i. Common Core for Basic Underground Hard Rock Mining Skills (Program #P770010). (Basic Common Core Program),
2.5 That non-miners working underground be trained in the fundamentals of ground control, including the recognition of potential hazards.	ii. Speciality Modules Underground Hard Rock Mining (Program #P770010),
2.6 That all mining supervisory staff receive adequate training in ground control. The ground control module for supervisors being developed by the tripartite committee on modular training shall be deemed adequate for this purpose.	iii. Common Core for First Line Production Supervisors Underground Hard Rock Mining (Program #P770120).
	2. Soft rock underground mines,
	i. Common Core for Basic Underground Soft Rock Mining Skills (Program #P770130). (Basic Common Core Program),
	ii. Speciality Modules Underground Soft Rock Mining (Program #P770130).

RECOMMENDATION

2. Training Continued

2.7 That health and safety committee members shall receive the same training in ground control as supervisory staff.

COMMENTS

10. (2) An employer shall train each full-time worker who commences employment after the 1st day of June, 1987 in the Basic Common Core Program described in subsection (1) appropriate for that worker and the training shall be given within the first year of employment.

10. (3) Subsection (2) does not apply if the worker successfully completed the Basic Common Core Program appropriate for that worker prior to being employed by the employer or was accredited under the predecessor of this section and gives the employer proof thereof.

10. (4) A certificate issued by the Ministry of Skills Development showing that a worker has successfully completed a training program referred to in subsection (1) is conclusive proof for the purposes of this section of the worker's successful completion of the program.

The curriculum of the Common Core program is established through the Tripartite Committee on Training which has representation by industry, labour and government, through the Ministry of Skills Development. This committee is establishing enhanced ground control modules with this program. A modular training program for supervisors has also been established with a separate module on ground control.

The Mining Health and Safety Branch has developed a number of training modules, including three ground control modules, which are available through the Mines Accident Prevention Association of Ontario.

The Ministry of Labour has sponsored, through a $400,000 grant, the establishment of a Training Centre in Ground Control at Cambrian College in Sudbury. This centre will establish training programs for all workers and supervisors, including health and safety committee members, for delivery throughout the province.

RECOMMENDATION	COMMENTS
3. POST SECONDARY EDUCATION	
3.1 That colleges and universities training mining engineers recognize that good undergraduate teaching in a subject such as rock mechanics demands lecturers who have a deep understanding of the subject, solid practical experience in its application in real mining situations, and the ability to present their material in clear and simple terms which will enable the students to apply their knowledge to the solution of the problems they will encounter in the industry.	
3.2 That the teaching staff in colleges and universities with rock mechanics programs shall have strong practical experience in underground hard rock mining.	
3.3 That qualified personnel from the mining industry participate in teaching graduate and undergraduate programs at colleges and universities with rock mechanics programs.	The ground control engineering specialists of the MNSB routinely provide lectures at colleges and universities within the province.
3.4 That additional funding be made available to colleges and universities to provide the improved facilities and instruction necessary to permit adequate training in ground control.	
3.5 That the mining industry shall establish a special chair in ground control at an Ontario university to improve the standard of teaching in rock mechanics for graduate and undergraduate students, and to conduct research projects directly related to the mining industry. This chair shall be closely identified with the Ontario mining industry.	The government of Ontario has established a chair in geomechanics research at Laurentian University and a second at Queen's University is being established. The mining industry, through Placer-Dome, has also established a special chair at the University of Toronto.

RECOMMENDATION	COMMENTS
3. Post Secondary Education Continued	
3.6 That instruction in ground control be integrated into the undergraduate programs in mining engineering. The Rock Mechanics and Strata Control Committee of the Canadian Institute of Mining and Metallurgy shall be asked to effect this change through the organization of a National Forum on mining-related ground control education.	A National Forum on mining education is planned for May 1988 in Edmonton, under the auspices of the Canadian Institute of Mining and Metallurgy.
3.7 That community colleges and universities offering mining programs be encouraged to develop additional short courses in ground control, targeted to specific groups in the mining industry.	The government of Ontario has undertaken a study of post-secondary programs in mining. This report, undertaken by C.B. Ross, was tabled with the Ministry of Labour in April 1987.
3.8 That the mining industry in Ontario be encouraged to sponsor their employees' attendance at existing short courses and other programs as they become available.	
3.9 That these short courses be designed so that adequate training can be given in various locations, including remote regions of the province.	
3.10 That certification courses be developed in practical ground control for practicing ground control engineers and other technical personnel.	
3.11 That the mining industry be encouraged to sponsor qualified employees who seek post-graduate degrees in rock mechanics.	

RECOMMENDATION	COMMENTS
4. COMMUNICATIONS	
4.1 That companies reassess the effectiveness of their methods of providing information on ground control and emergency preparedness to employees.	A new regulation, section 62a. has been included in the Regulations for Mines and Mining Plants which requires each mine to establish a communication procedure regarding ground conditions between workers and supervisors. 62a. (1) An employer in an underground mine, in consultation with the joint health and safety committee, if any, for the mine, shall develop a written program to provide for the timely communication of information between workers and supervisors in the mine respecting ground stability, ground movement, falls of ground, ground monitoring equipment and emergencies. (2) The communications program shall set out, (a) means and procedures for communicating information; (b) the kind of information to be communicated; and (c) the actions to be taken by supervisors and workers with respect to information that is communicated to them.
4.2 That mining companies recognize that it is the responsibility of management to establish direct and effective communication between management and workers, and to ensure that adequate mechanisms exist for clear and timely feedback from workers to management.	
4.3 That management should also ensure that mechanisms are in place to provide effective communication between workers on cross-shifts, and that these means of communication be available to both workers and supervisors.	
4.4 That research to perfect the development of an effective radio communication device for use underground be continued and accelerated, with active government support.	The MHSB has sponsored a seminar on radio communication devices with widespread industry attendance. The Branch will continue to support development of a practical system and encourage its use in all mines.
4.5 That once developed an available, these devices be installed in underground locations as necessary.	

RECOMMENDATION	COMMENTS
5. MINE DESIGN AND PLANNING	
5.1 That mine design continue to be recognized as the sole responsibility of management, and that management accept the need to use appropriate technology in designing mines.	A new regulation, Section 5a. has been established. It requires each mine to prepare a mine design that addresses all aspects of ground control at least annually.
5.2 That mine design and subsequent implementation be under the direction of a technically competent person.	5a. (1) The owner of a surface mine producing metallic ore or of an underground mine shall prepare and maintain a mine design assessing the ground stability of the active and proposed workings of the mine.
5.3 That every underground mine be required to prepare a ground control micro-environment design prior to the introduction of a new mining method, or the introduction of any expansion of the present mine design; such designs shall be submitted to the Ministry of Labour as required by section 5 of the mining regulations.	(2) The mine design shall consist of drawings, plans or specifications and shall,
5.4 That technically competent personnel of the Ministry of Labour review ground control design and procedures at all Ontario mines, at the mine site, at least once per year, and more frequently as required.	(a) describe the geology of the mine;
5.5 That the principles and details underlying the mine designs referred to in Recommendation #3 be communicated directly to persons concerned at all levels of the operation, including the appropriate officials of the union representing the mine crews; and that this communication take place before and during the implementation of the design.	(b) outline the geometry of existing and proposed excavations;
	(c) describe previous occurrences of ground instability;
	(d) describe the mining method including stope sequencing and blasting methods;
	(e) specify the ground support system; and
	(f) describe measures planned and used to assess potential ground instability such as instrumentation and computer modelling.
	(3) The mine design shall be assessed and updated at least annually and also before any alteration is made to the mine that may significantly affect the ground stability of the mine.

RECOMMENDATION	COMMENTS
5. Mine Design and Planning Continued	
5.6 That the Ministry of Labour review and monitor the regional stability affecting underground mines in Ontario, and discuss potential problems with the mining companies involved.	5a. (4) The mine design shall be available at the mine site for review by an engineer of the Ministry and by the joint health and safety committee, if any, for the mine. (5) Where an engineer of the Ministry so requires in writing, an owner of a mine to whom this section applies shall provide, at the owner's expense, a report by a professional engineer stating that the mine design for the mine conforms to good engineering practice. The MHSB has implemented a program to audit the mine design required under section 5a. and the communications procedure required under section 62a. Two additional ground control engineers have been hired for this program.
5.7 That mining companies sharing a common boundary exchange information that may affect the regional stability of either or both.	Section 5a. requires that the mine design be shared with the worker's representatives. Regional stability will be addressed as part of the mine design audits.
5.8 That workplace mining plans be made available to miners and be discussed with them, including any indications of abnormal ground conditions, geological anomalies, and the location of ground monitoring instruments, as a method of ensuring worker participation in planning ground control procedures in the "micro" environment.	The implementation of regulations 5a. and 62a. address the identification and communication of abnormal ground conditions between management and worker.

RECOMMENDATION	COMMENTS
6. EMERGENCY PREPAREDNESS	
6.1 That the current mine rescue organization be expanded to handle all underground emergencies.	There has been an expanded role of the mine rescue organization in non-fire emergencies. The principal focus of this expansion was towards evaluating and acquiring equipment which would assist in rescuing miners. The workload resulting from this expansion of equipment and training, required a workload study which resulted in one additional mine rescue officer being recruited.
6.2 That the necessary additional training in non-fire emergencies be developed by a tripartite committee consisting of representatives of mine management, unions and government.	The nature of the training required for non-fire emergencies has required considerable study. A tripartite committee was established to assist in determining these training needs. The tripartite committee referred to above has reviewed and advised on the long-term role of mine rescue including mine rescue equipment.
6.3 That a tripartite committee also be established to advise on all aspects of mine rescue equipment and emergency warning systems.	
6.4 That mine rescue personnel suffer no loss of income as a result of injuries arising from mine rescue activities.	Current WCB legislation provides for 90% of a miner's regular wages. In addition some employers do ensure that injured employees suffer no loss of wages.
6.5 That the Ministry of Labour Mine Rescue organization be responsible for identifying and introducing specialized equipment needed for use in non-fire emergencies, an for developing or finding sources for such equipment.	The mine rescue organization has continuously evaluated new products for fire, and more recently, non-fire emergencies. This is an ongoing program to ensure the best technology is being used. Some non-fire emergency equipment is being sourced and evaluated by other specialists within the MMSB such as the working environment and the ground control staff. The sources and equipment evaluations of any specialized equipment will be put onto a computerized data base to enable quick retrieval. Some of the non-fire equipment has already proved its worth during recent emergencies.

RECOMMENDATION	COMMENTS
6. Emergency Preparedness Continued	
6.6 That manway sizes, escape routes and refuge stations be sufficient to accommodate rescue operations.	Guidelines and regulations are in place for manway sizes, escape routes and refuge station locations.
6.7 That the Workers' Compensation Board re-evaluate the qualifications required for mine first-aid attendants.	
6.8 That all underground workers be encouraged to take first-aid training and to keep their training current.	The supervisor's training program, now includes first-aid training. Most mines encourage workers to take first-aid training.
6.9 That the Ministry of Labour, with the assistance of the Mining Legislative Review Committee, draft comprehensive first-aid regulations with specific reference to underground mining operations.	First-aid regulations have been drafted and will be tabled for discussion at the MLRC meeting in February 1988.

RECOMMENDATION	COMMENTS
7. MINE LIGHTING	
7.1 That auxiliary high-intensity lighting be available in all active work areas to assist in ground-control-related activities such as inspection and scaling.	The MHSB has conducted a study into the effectiveness of miner's cap lamps in relation to ground control procedures. As a result a minimum standard has been established. Regulation 65a. has been added to regulate this standard. This regulation further requires the use of auxiliary lighting where necessary.
7.2 That within one year of the release of this report lighting standards -- as they relate to ground control and emergency preparedness-shall be established for use in all underground mines.	65a. (1) Illumination shall be provided in an underground mine adequate for a worker to visually assess ground conditions at the worker's work place. (2) Where a cap lamp is used to provide the illumination as required by subsection (1), it shall be capable of providing a peak illuminance of at least 1500 lux at 1.2 metres from the light source. (3) An employer in an underground mine who supplies cap lamps to workers shall develop a procedure for assessing and maintaining cap lamps and a copy of the procedure shall be available a the mine site for review by an engineer of the Ministry and by the joint health and safety committee, if any, for the mine. (4) A record of cap lamp maintenance test results shall be kept. (5) Notwithstanding subsection (2), if the ground to be assessed is at a distance that is greater than the effective range of a cap lamp, the employer shall supply, and the worker shall use, auxiliary lighting that will provide the illumination required by subsection (1). (6) This section comes into force on the 1st day of June, 1988.

RECOMMENDATION	COMMENTS
8. MONITORING AND INSTRUMENTATION	
8.1 That research into improved rock mechanics instrumentation of all types be undertaken.	The Mining Research Directorate is presently reviewing needed research and development of improved monitoring devices.
8.2 That specific research to develop improved, reasonable-cost measuring devices be pursued.	
8.3 That guidelines be developed for the interpretation of data produced by ground monitoring devices.	The Mines Accident Prevention Association of Ontario is developing a series of brochures to explain the various types of instrumentation used and to provide guidance to their use and interpreting results.
8.4 That all information obtained from ground monitoring devices at a particular mine be provided to the union representing workers in that mine.	Regulations 5a. and 62a. adequately address the collection and communication of information related to the evaluation of ground control monitoring devices.
8.5 That any evaluations of ground conditions in areas being mined shall be given to the union representing workers in each mine, and shall also be communicated directly to the workers involved.	
8.6 That mines experiencing on-going rockbursting problems install instruments, such as micro-seismic monitoring devices, to monitor seismicity in the affected areas.	Regulation 66 provides the authority for an engineer of the Ministry to require the installation of monitoring devices should the company be unwilling to do so.

RECOMMENDATION	COMMENTS
9. MISCELLANEOUS	
Soft Rock	
9.1 That soft rock mining operations be considered separately from hardrock mining in setting standards related to ground control practices.	The revised section 10 of the regulations recognizes a separate training program for soft rock mines.
Ministry of Labour	
9.2 That the Ministry of Labour, through training and recruitment, ensure that its ground control staff be at a world-class level in their discipline, and have the credibility to relate effectively to the international ground control community.	The MHSB has recently doubled its complement to four with the recruitment of two mining engineers with post-graduate degrees in rock mechanics. The ground control staff maintain an active participation in international and national bodies like the Rock Mechanics and Strata Control Committee. The Branch is involved in a cooperative agreement with the Canadian and US governments to exchange information on ground control and related research.
9.3 That the Ministry of Labour establish a Technical Support Centre with the following functions:	The government of Ontario has announced the establishment of a Technical Support Centre at Sudbury which is related to the relocation of the MHSB staff from Toronto. The Centre, to be established adjacent to Laurentian University, will provide expanded facilities.
a) to support an expanded role in predevelopment review and annual mine design review as recommended elsewhere in this report;	
b) to establish facilities for training in ground control (although this should not conflict with existing established training programs).	The ground control department has already begun to acquire an array of equipment available for emergency responses or special investigations.
c) to develop, and provide to mines on short-term loan, ground control instruments and testing equipment;	

RECOMMENDATION	COMMENTS
9. Miscellaneous Continued	
9.3 d) to establish and maintain a computerized data base containing operational information on ground control and emergency preparedness and provide access to it to the mining industry, and to the research coordinating body recommended elsewhere in this report;	Databases of falls of ground and rockbursts within the province have been established in order to better identify hazards or trends.
e) to develop and maintain a library of computer software related to ground control technology, and especially to the interpretation of data from ground control monitoring devices.	MHSB engineers in conjunction with the U.S. Bureau of Mines and the Federal Department of Energy Mines & Resources are presently compiling a database of ground control related software as part of its cooperative agreement on ground control. Branch engineers are also involved with a subcommittee of the Canadian Institute of Mining to develop an expanded database in this regard.
f) The specialist ground control engineers employed in the Technical Support Centre should not be involved in the regulatory functions of the Ministry.	The primary role of the MHSB ground control engineers is to provide technical support, through advice and training, to the inspectors. Enforcement of the regulations is the responsibility of the inspectorate.
g) The Technical Support Centre shall not be in conflict with the research coordinating body recommended elsewhere in this report.	Branch staff maintain active contact with the Mining Research Directorate with the intent that research be coordinated through that agency.
9.4 That Ministry of Labour inspectors be provided with such additional training as may be required to enable them to deal effectively with site-specific ground control problems.	The MHSB has developed an extensive training program for its inspectors which includes a significant ground control component.
9.5 That these inspectors enforce ground control regulations more vigorously.	The ground control audit program established by the Branch is intended to focus subsequent inspections with respect to ground control regulations.

RECOMMENDATION	COMMENTS
9. Miscellaneous Continued	
<u>Fall-On Protection Systems</u>	
9.6 That Fall-on Protection shall be mandatory on all vehicles operating in areas requiring this type of protection. The recommendation shall be referred to the established FOPS sub-committee which will develop standards for its implementation.	A new regulation section 66a. has been added which required fall-on protection for mobile vehicles in certain situations. 66a. (1) Devices to protect operators from falling objects shall be installed on every motorized trackless vehicle used, (2) Devices required by subsection (1) shall consist of overhead protective devices built to withstand a minimum of 11.5 kilojoules of energy when tested in accordance with the Society of Automotive Engineers' Standard SAE J231 "Minimum Performance Criteria for Falling Object Protective Structures (FOPS)" and the devices shall be maintained in good condition. (a) in a new underground mine that is developed after the 1st day of June, 1988; or (b) in an area in an underground mine with respect to which an engineer of the Ministry has given the owner a written opinion that local ground stability presents a hazard to the operators. (3) Clause (1)(a) does not apply to a motorized trackless vehicle while it is being used in an area in an underground mine that is made safe by scaling, timbering or rockbolting or by measures that provide safety equal to or better than scaling, timbering or rockbolting. (4) This Regulation comes into force on the 1st day of June, 1987.

RECOMMENDATION

9. Miscellaneous Continued

Worker Inspectors

9.7 That worker-inspectors, where they exist, be given the same training in ground control as that recommended for supervisory staff elsewhere in this report.

This Committee

9.8 That this committee will remain seized with this study and will reconvene as necessary to discuss matters requiring further attention and to monitor progress on the implementation of these recommendations.